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Scientists, Engineers, and Technicians in Manufacturing Industries: 1989

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Surveys of Science Resources Studies
National Science Foundation Detailed Statistical Tables
NSF 92-312

Scientists, Engineers, and Technicians in Manufacturing Industries: 1989

Project Director: Joseph P. Gannon

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This report was prepared in the Division of Science Resources Studies (SRS) by Joseph P. Gannon, Science Resources Analyst, Science and Engineering Personnel Program (PER), under the general direction of Carolyn Shettle, Program Director, PER. Secretarial and other support services were provided by Tanya Gore and Simone Keith. The Editor was Millicent V. Gough, and the Editorial Assistants were Elizabeth J. Michael and Julia H. Harriston, under the direction of Richard E. Morrison, Publications Manager, SRS. Kenneth M. Brown, Director, SRS, provided overall guidance.

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I. General Notes

In this report, estimates are presented on the total numbers of scientists, engineers, and technicians (SETs) who were employed in manufacturing industries in 1989. The estimates were developed from the Labor Department's Occupational Employment Statistics (OES) Survey, a Federal/State program that produces national and State estimates of employment by industry for nonfarm wage and salary workers. The Bureau of Labor Statistics (BLS) has the primary responsibility for developing OES survey procedures and providing technical guidance and assistance with survey problems. State Employment Security Agencies implement the survey at State levels and prepare current and projected employment statistics for these labor markets. Some States also prepare sub-State estimates.

The National Science Foundation (NSF) has enhanced the BLS effort since 1977 by financing the collection of full details on the types of scientific and technical jobs filled by industry. Analysis of this information provides insight into the dynamics of the labor market.

Requests for previously published data and additional information should be addressed as follows:

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SECTION II. DETAILED STATISTICAL TABLES

NOTE

Industries identified in the tables of this report are from the "Numerical List of Short Titles" in the ***Standard Industrial Classification (SIC) Manual,*** revised 1987 edition. The numbers of scientists, engineers, and technicians (SETs) for a few industries at the 2-digit SIC level in 1989 (tables A-2 and A-4) differ from those in the prior report on manufacturing industries for 1986 because the industries were recoded. Greater noncomparability occurred at the 3-digit level of detail (tables A-1, A-3, A-4, and A-5) because of more extensive recoding. The numerous industry title changes did not affect the comparability of the 1989 and 1986 occupational estimates.

Estimates in the tables of this report may be compared with those for 1986 only after consulting the 1987 SIC revisions to determine industry comparability.

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Table A-1. Scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by detailed industry of employment: 1989

Numbers of filled jobs in thousands

Detailed industry	Total SET(1) personnel		SET personnel managers		Scientists		Engineers		Technicians	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total manufacturing	1,726.8	100.0	144.4	100.0	192.4	100.0	804.1	100.0	585.9	100.0
DURABLE GOODS	1,365.1	79.1	111.2	77.0	92.7	48.2	703.5	87.5	457.8	78.1
Lumber and wood products	9.5	.6	.8	.6	2.0	1.0	1.7	.2	5.0	.9
Logging	.6	(2)	(2)	(2)	.5	.3	(2)	(2)	(2)	(2)
Sawmills and planing mills	2.1	.1	.2	.1	1.0	.5	.5	.1	.4	.1
Millwork, plywood & structural members	4.4	.3	.3	.2	.3	.2	.7	.1	3.0	.5
Wood containers	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Wood buildings and mobile homes	1.4	.1	.1	.1	(2)	(2)	.1	(2)	1.2	.2
Misc. wood products	.9	.1	.1	.1	.1	.1	.3	(2)	.3	.1
Furniture and fixtures	10.3	.6	1.3	.9	.8	.4	3.3	.4	4.9	.8
Household furniture	2.7	.2	.5	.3	.3	.2	.8	.1	1.1	.2
Office furniture	2.2	.1	.4	.2	.2	.1	.8	.1	.8	.1
Public building & related furniture	1.1	.1	.1	.1	(2)	(2)	.4	.1	.5	.1
Partitions and fixtures	3.1	.2	.3	.2	.1	.1	.8	.1	1.9	.3
Misc. furniture and fixtures	1.2	.1	.1	.1	.1	.1	.4	(2)	.5	.1
Stone, clay, and glass products	17.7	1.0	1.6	1.1	1.4	.7	7.4	.9	7.3	1.3
Flat glass	.9	.1	(2)	(2)	.1	(2)	.5	.1	.3	.1
Glass and glassware, pressed or blown	3.4	.2	.4	.3	.2	.1	1.4	.2	1.3	.2
Products of purchased glass	1.2	.1	.1	.1	.1	.1	.6	.1	.4	.1
Cement, hydraulic	1.1	.1	.1	(2)	.2	.1	.3	(2)	.5	.1
Structural clay products	1.1	.1	.1	.1	(2)	(2)	.6	.1	.4	.1
Pottery and related products	1.5	.1	.1	.1	.1	(2)	.6	.1	.7	.1
Concrete, gypsum, and plaster products	3.1	.2	.3	.2	.1	.1	1.1	.1	1.6	.3
Cut stone and stone products	.4	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.3	(2)
Misc. nonmetallic mineral products	5.0	.3	.4	.3	.6	.3	2.3	.3	1.7	.3
Primary metals	39.9	2.3	3.7	2.5	4.3	2.3	18.2	2.3	13.6	2.3
Blast furnaces and basic steel products	14.0	.8	1.4	1.0	1.8	.9	6.3	.8	4.5	.8
Iron and steel foundries	5.1	.3	.4	.3	.3	.1	2.7	.3	1.8	.3
Primary nonferrous metals	3.0	.2	.2	.1	.4	.2	1.1	.1	1.2	.2
Secondary nonferrous metals	.7	(2)	.1	.1	.1	.1	.2	(2)	.3	(2)
Nonferrous rolling and drawing	12.8	.7	1.2	.8	1.5	.8	5.7	.7	4.4	.8
Nonferrous foundries (castings)	2.7	0.2	0.3	0.2	0.1	0.1	1.4	0.2	0.9	0.1
Misc. primary metal products	1.5	.1	.1	.1	.1	.1	.8	.1	.5	.1
Fabricated metal products	71.2	4.1	6.9	4.8	3.0	1.6	31.6	3.9	29.7	5.1
Metal cans and shipping containers	1.2	.1	.2	.1	.2	.1	.6	.1	.5	.1
Cutlery, handtools, and hardware	5.6	.3	.7	.5	.4	.2	2.8	.4	1.7	.3
Plumbing and heating, except electric	3.0	.2	.4	.3	.2	.1	1.2	.2	1.2	.2
Fabricated structural metal products	25.1	1.5	1.9	1.3	.7	.4	8.2	1.0	14.3	2.4
Screw machine products, bolts, etc.	4.0	.2	.5	.3	.2	.1	1.9	.2	1.3	.2
Metal forgings and stampings	9.1	.5	.9	.6	.4	.2	5.0	.6	2.8	.5
Metal services, n.e.c.	1.8	.1	.2	.1	.1	(2)	.8	.1	.8	.1
Ordnance and accessories, n.e.c.	9.4	.5	.8	.6	.4	.2	5.5	.7	2.7	.5
Misc. fabricated metal products	11.6	.7	1.3	.9	.4	.2	5.6	.7	4.4	.8
Machinery, except electrical	334.2	19.4	33.1	22.9	19.5	10.1	163.5	20.3	118.1	20.2
Engines and turbines	16.3	.9	1.3	.9	.9	.5	9.7	1.2	4.4	.8
Farm and garden machinery	7.3	.4	.6	.4	1.0	.5	3.2	.4	2.5	.4
Construction and related machinery	26.0	1.5	2.4	1.6	1.9	1.0	12.8	1.6	8.9	1.5
Metalworking machinery	28.6	1.7	2.9	2.0	.8	.4	14.3	1.8	10.5	1.8
Special industry machinery	22.0	1.3	2.0	1.4	.6	.3	10.8	1.3	8.7	1.5
General industrial machinery	26.3	1.5	2.6	1.8	.8	.4	13.2	1.6	9.6	1.6
Computer and office equipment	176.3	10.2	17.4	12.0	12.4	6.5	84.4	10.5	62.2	10.6
Refrigeration and service machinery	12.3	.7	1.4	1.0	.6	.3	5.5	.7	4.9	.8
Misc. machinery, n.e.c.	19.0	1.1	2.4	1.7	.6	.3	9.6	1.2	6.3	1.1
Electrical machinery	292.3	16.9	23.3	16.1	13.0	6.8	147.7	18.4	108.3	18.5
Electric distribution equipment	12.6	.7	1.1	.7	.8	.4	6.2	.8	4.6	.8
Electrical industrial apparatus	23.3	1.3	1.8	1.2	.8	.4	11.9	1.5	8.8	1.5
Household appliances	5.5	.3	.5	.3	.6	.3	2.7	.3	1.7	.3
Electric lighting and wiring equipment	11.2	.7	1.3	.9	.7	.4	5.4	.7	3.7	.6
Household audio and video equipment	10.2	.6	.6	.4	.3	.2	5.7	.7	3.6	.6
Communications equipment	73.3	4.2	5.3	3.7	3.0	1.6	39.3	4.9	25.7	4.4
Electronic components and accessories	137.5	8.0	11.4	7.9	5.9	3.1	66.6	8.3	53.6	9.1
Misc. electrical equipment and supplies	18.7	1.1	1.4	.9	.8	.4	10.0	1.2	6.6	1.1
Transportation equipment	341.0	19.7	18.4	12.7	28.5	14.8	209.1	26.0	85.0	14.5
Motor vehicles and equipment	70.2	4.1	3.1	2.2	5.0	2.6	39.2	4.9	22.9	3.9
Aircraft and parts	172.6	10.0	9.3	6.4	16.8	8.7	107.3	13.3	39.3	6.7
Ship and boat building and repairing	14.6	.8	1.1	.8	.8	.4	7.3	.9	5.4	.9
Railroad equipment	1.3	.1	.1	.1	.1	(2)	.6	.1	.5	.1
Motorbicycles, bicycles, and parts	.4	(2)	(2)	(2)	.1	(2)	.2	(2)	.1	(2)
Guided missiles, space vehicles, parts	78.7	4.6	4.5	3.1	5.7	3.0	52.7	6.6	15.8	2.7
Misc. transportation equipment	3.2	.2	.2	.2	(2)	(2)	1.9	.2	1.0	.2
Instruments	240.2	13.9	21.0	14.6	19.1	9.9	118.1	14.7	82.0	14.0
Search and Navigation equipment	123.3	7.1	10.8	7.4	9.8	5.1	64.1	8.0	38.6	6.6
Measuring and controlling devices	74.0	4.3	6.1	4.2	4.1	2.1	37.4	4.7	26.4	4.5
Medical instruments and supplies	30.0	1.7	3.0	2.1	3.6	1.9	11.6	1.4	11.8	2.0
Opthalmic goods	1.8	.1	.2	.2	.3	.2	.6	.1	.6	.1
Photographic equipment and supplies	10.7	.6	.9	.6	1.2	.6	4.3	.5	4.3	.7
Watches, clocks, watchcases, and parts	.5	(2)	.1	(2)	(2)	(2)	.2	(2)	.2	(2)
Misc. manufacturing	8.7	.5	1.1	.8	.9	.5	2.9	.4	3.8	.6
Jewelry, silverware, and plated ware	.5	(2)	.1	.1	.1	.1	.1	(2)	.2	(2)
Musical instruments	.3	(2)	(2)	(2)	(2)	(2)	.1	(2)	.1	(2)
Toys and sporting goods	3.0	.2	.4	.3	.3	.2	1.2	.2	1.1	.2
Pens, pencils, office & art supplies	.8	(2)	.1	.1	.1	(2)	.3	(2)	.3	(2)
Custume jewelry and notions	.4	(2)	.1	.1	(2)	(2)	.2	(2)	.2	(2)
Misc. manufactures	3.7	.2	.3	.2	.3	.2	1.0	.1	2.0	.3

See explanatory information, if any, and SOURCES at end of table.

Table A-1. Scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by detailed industry of employment: 1989--Continued

Numbers of filled jobs in thousands

Detailed industry	Total SET(1) personnel		SET personnel managers		Scientists		Engineers		Technicians	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
NONDURABLE GOODS	361.7	20.9	33.2	23.0	99.8	51.8	100.5	12.5	128.2	21.9
Food and kindred products	40.9	2.4	5.3	3.7	9.9	5.2	9.0	1.1	16.7	2.8
Meat products	4.1	.2	.5	.4	.8	.4	1.0	.1	1.7	.3
Dairy products	4.8	.3	.6	.4	.9	.5	.9	.1	2.4	.4
Preserved fruits and vegetables	6.4	.4	.9	.6	1.5	.8	1.1	.1	2.9	.5
Grain mill products	5.2	.3	.6	.4	1.4	.7	1.0	.1	2.2	.4
Bakery products	4.5	.3	.8	.5	1.0	.5	1.2	.1	1.5	.3
Sugar and confectionery products	3.3	.2	.4	.3	.8	.4	.9	.1	1.3	.2
Fats and oils	1.5	.1	.1	.1	.5	.3	.2	(2)	.7	.1
Beverages	6.8	0.4	0.8	0.5	2.0	1.0	1.6	0.2	2.5	0.4
Misc. food and kindred products	4.2	.2	.6	.4	1.0	.5	1.2	.1	1.4	.2
Tobacco products	4.1	.2	.4	.3	1.5	.8	1.2	.1	1.0	.2
Cigarettes	3.9	.2	.4	.2	1.5	.8	1.1	.1	1.0	.2
Cigars	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Chewing and smoking tobacco	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Tobacco stemming and redrying	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Textile mill products	11.9	.7	1.3	.9	2.4	1.2	3.3	.4	4.9	.8
Broadwoven fabric mills, cotton	1.6	.1	.1	.1	.3	.2	.5	.1	.6	.1
Broadwoven fabric mills, manmade	2.3	.1	.4	.3	.6	.3	.6	.1	.7	.1
Broadwoven fabric mills, wool	.4	(2)	.1	(2)	.1	(2)	.2	(2)	.1	(2)
Narrow fabric mills	.3	(2)	(2)	(2)	(2)	(2)	.1	(2)	.1	(2)
Knitting mills	2.0	.1	.2	.1	.3	.2	.5	.1	.9	.2
Textile finishing, except wool	1.2	.1	.1	.1	.3	.2	.2	(2)	.6	.1
Carpets and rugs	1.1	.1	.1	.1	.3	.2	.3	(2)	.4	.1
Yarn and thread mills	1.2	.1	.1	.1	.1	.1	.4	.1	.5	.1
Misc. textile goods	1.6	.1	.2	.1	.3	.1	.5	.1	.9	.1
Apparel and other finished products made from fabrics and similar materials	7.0	.4	1.0	.7	.8	.4	2.7	.3	2.4	.4
Men's and boys' suits and coats	.3	(2)	(2)	(2)	(2)	(2)	.1	(2)	.1	(2)
Men's and boys' furnishings	1.6	.1	.2	.1	.2	.1	.6	.1	.6	.1
Women's and misses' outerwear	1.3	.1	.2	.1	.3	.1	.4	.1	.4	.1
Women's and children's undergarments	.6	(2)	.1	.1	.1	(2)	.2	(2)	.2	(2)
Hats, caps, and millinery	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Girls' and children's outerwear	.4	(2)	(2)	(2)	.1	(2)	.2	(2)	.2	(2)
Fur goods	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. apparel and accessories	.2	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1	(2)
Misc. fabricated textile products	2.5	.1	.4	.3	.2	.1	1.1	.1	.8	.1
Paper and allied products	26.5	1.5	2.8	2.0	4.2	2.2	11.3	1.4	8.2	1.4
Pulp mills	1.3	.1	.1	.1	.3	.2	.4	.1	.4	.1
Paper mills	8.6	.5	.7	.5	1.0	.5	3.8	.5	3.0	.5
Paperboard mills	2.3	.1	.1	.1	.3	.2	1.1	.1	.7	.1
Paperboard containers and boxes	2.4	0.1	0.3	0.2	0.3	0.2	1.1	0.1	0.6	0.1
Misc. converted paper products	11.9	.7	1.5	1.0	2.2	1.1	4.8	.6	3.4	.6
Printing, publishing, and allied industries	21.6	1.2	3.1	2.1	7.6	3.9	2.5	.3	8.4	1.4
Newspapers	4.3	.3	.8	.6	1.7	.9	.3	(2)	1.5	.3
Periodicals	3.4	.2	.4	.3	1.3	.7	.1	(2)	1.6	.3
Books	2.9	.2	.5	.3	1.3	.7	.2	(2)	.9	.2
Misc. publishing	2.8	.2	.3	.2	.8	.4	.3	(2)	1.5	.2
Commercial printing	4.3	.3	.6	.4	1.0	.5	.8	.1	1.8	.3
Manifold business forms	.9	.1	.1	.1	.2	.1	.3	(2)	.3	.1
Greeting cards	1.2	.1	(2)	(2)	.8	.4	.2	(2)	.1	(2)
Blankbooks and bookbinding	.7	(2)	.1	.1	.1	.1	.2	(2)	.3	.1
Printing trade services	.9	.1	.1	.1	.2	.1	.1	(2)	.5	.1
Chemicals and allied products	192.4	11.1	13.4	9.3	66.1	34.4	46.7	5.8	66.3	11.3
Industrial inorganic chemicals	23.5	1.4	1.5	1.1	5.4	2.8	9.7	1.2	6.8	1.2
Plastics materials and synthetics	32.4	1.9	1.8	1.3	7.2	3.7	11.3	1.4	12.1	2.1
Drugs	55.1	3.2	4.7	3.3	28.7	14.9	4.9	.6	16.7	2.9
Soaps, cleaners, and toilet goods	14.8	.9	1.7	1.2	6.0	3.1	2.6	.3	4.5	.8
Paints and allied products	9.1	.5	.4	.3	3.9	2.0	1.0	.1	3.8	.6
Industrial organic chemicals	38.1	2.2	1.8	1.3	9.5	5.0	11.5	1.4	15.3	2.6
Agricultural chemicals	5.5	.3	.4	.3	1.6	.8	1.4	.2	2.0	.3
Misc. chemical products	14.0	.8	1.0	.7	3.8	2.0	4.2	.5	5.0	.8
Petroleum refining and related products	22.3	1.3	1.3	.9	4.2	2.2	8.7	1.1	8.0	1.4
Petroleum refining	20.4	1.2	1.1	.7	3.7	1.9	8.3	1.0	7.3	1.2
Asphalt paving and roofing materials	.8	(2)	.1	.1	.1	.1	.2	(2)	.3	.1
Misc. petroleum and coal products	1.1	.1	.1	.1	.4	.2	.2	(2)	.4	.1
Rubber and miscellaneous plastics products	33.5	1.9	4.3	3.0	2.6	1.3	14.8	1.8	11.8	2.0
Tires and inner tubes	3.6	.2	.4	.2	.4	.2	1.5	.2	1.3	.2
Rubber and plastics footwear	.2	(2)	(2)	(2)	.1	(2)	.1	(2)	.1	(2)
Hose & belting & gaskets & packing	3.3	.2	.5	.3	.3	.1	1.5	.2	1.1	.2
Fabricated rubber products, n.e.c.	5.2	.3	.5	.4	.6	.3	2.1	.3	2.0	.3
Misc. plastic products, n.e.c.	21.1	1.2	2.9	2.0	1.3	.7	9.6	1.2	7.3	1.3
Leather and leather products	1.5	.1	.2	.1	.4	.2	.3	(2)	.5	.1
Leather tanning and finishing	.2	(2)	(2)	(2)	.1	(2)	(2)	(2)	.1	(2)
Footwear cut stock	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Footwear, except rubber	1.0	0.1	0.1	0.1	0.3	0.2	0.2	(2)	0.3	0.1
Leather gloves and mittens	(2)	(2)	(2)	(2)	(2)	(2)	(2)	0.0	(2)	(2)
Luggage	.2	(2)	(2)	(2)	(2)	(2)	.1	(2)	(2)	(2)
Handbags and personal leather goods	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Leather goods, n.e.c.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

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(1) Scientific, engineering, and technical personnel.
(2) No amount available or value less than .05 for levels and and .005 for percents
NOTES: Because of rounding, components may not add to totals.
N.e.c. = Not elsewhere classified
SOURCES: Occupational Employment Statistics Survey of the Bureau of Labor Statistics, and National Science Foundation, SRS.

Table A-2. Scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1989

Numbers of filled jobs in thousands

Broad industry group of employment	Total SET(1) personnel	SET Managers	Scientists				
			Total	Physical	Mathematical	Life	Computer analyst
Total manufacturing	1,726.8	144.4	192.4	54.8	11.6	23.2	102.8
DURABLE GOODS	1,365.1	111.2	92.7	6.5	10.9	3.3	71.9
Lumber and wood products	9.5	.8	2.0	-	-	1.5	.5
Furniture and fixtures	10.3	1.3	.8	-	-	(2)	.8
Stone, clay, and glass products	17.7	1.6	1.4	.6	-	-	.8
Primary metals	39.9	3.7	4.3	1.6	-	-	2.7
Fabricated metal products	71.2	6.9	3.0	-	-	(2)	3.0
Machinery, except electrical	334.2	33.1	19.5	-	1.8	.1	17.6
Electrical machinery	292.3	23.3	13.0	1.7	1.3	(2)	9.9
Transportation equipment	341.0	18.4	28.5	-	7.0	.1	21.4
Instruments	240.2	21.0	19.1	2.5	.7	1.6	14.2
Miscellaneous manufacturing	8.7	1.1	.9	-	-	(2)	.9
NONDURABLE GOODS	361.7	33.2	99.8	48.3	.7	19.9	30.9
Food and food products	40.9	5.3	9.9	4.6	-	1.0	4.3
Tobacco products	4.1	.4	1.5	.6	-	.1	.8
Textiles	11.3	1.3	2.4	.9	-	(2)	1.5
Apparel	7.0	1.0	.8	(2)	-	-	.8
Paper and allied products	26.5	2.8	4.2	1.6	.0	.2	2.4
Printing and publishing	21.6	3.1	7.6	-	-	.2	7.4
Chemicals	192.4	13.4	66.1	36.4	.7	18.2	10.8
Refined petroleum products	22.3	1.3	4.2	2.9		(2)	1.2
Rubber and plastic products	33.5	4.3	2.6	1.1	-	.1	1.3
Leather products	1.5	.2	.4	(2)	-	(2)	.4

See explanatory information, if any, and SOURCES at end of table.

Table A-2. Scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1989--Continued

Numbers of filled jobs in thousands

Broad industry group of employment	Engineers								
	Total	Aero-nautical	Chem-ical	Civil	Elec-trical/elec-tronics	Mechan-ical	Indus-trial	Sales	Other
Total manufacturing.....	804.1	48.9	31.3	8.2	202.5	142.6	103.9	37.9	228.5
DURABLE GOODS............	703.5	48.9	6.7	6.2	196.3	119.1	88.3	32.8	205.2
Lumber and wood products...............	1.7	-	-	-	-	.5	.5	.1	.5
Furniture and fixtures	3.3	-	-	-	-	1.2	1.3	.3	.5
Stone, clay, and glass products...............	7.4	-	.5	.6	.3	1.6	1.3	.7	1.9
Primary metals.........	18.2	-	-	-	1.7	3.7	3.1	.9	8.8
Fabricated metal products...............	31.6	-	-	1.1	1.8	12.7	5.3	3.3	7.5
Machinery, except electrical............	163.5	-	1.0	.7	41.9	39.5	14.1	13.0	53.2
Electrical machinery..	147.7	-	2.1	1.7	68.7	18.2	14.6	8.1	34.3
Transportation equipment..............	209.1	48.9	1.4	2.2	25.1	25.9	33.1	2.3	70.1
Instruments............	118.1	-	1.6	-	56.3	14.6	14.2	3.9	27.5
Miscellaneous manufacturing..........	2.9	-	-	-	-	1.2	.8	.1	.9
NONDURABLE GOODS.........	100.5	-	24.6	2.0	6.2	23.5	15.5	5.2	23.3
Food and food products	9.0	-	-	-	-	3.7	2.6	.1	2.6
Tobacco products.......	1.2	-	-	-	-	(2)	.1	-	1.0
Textiles...............	3.3	-	-	-	-	.9	1.8	.1	.4
Apparel................	2.7	-	-	-	-	.7	1.6	.1	.3
Paper and allied products...............	11.3	.0	1.9	.0	1.1	2.5	1.6	.3	4.0
Printing and publishing.............	2.5	-	-	-	-	.7	.7	.2	.9
Chemicals..............	46.7	-	17.7	1.5	3.5	8.0	3.8	3.0	9.3
Refined petroleum products...............	8.7	-	3.2	.5	.7	1.3	.5	.2	2.3
Rubber and plastic products...............	14.8	-	1.9	-	.9	5.7	2.6	1.2	2.3
Leather products.......	.3	-	-	-	-	.1	.2	-	.1

See explanatory information, if any, and SOURCES at end of table.

Table A-2. Scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1983--Continued

Numbers of filled jobs in thousands

Broad industry group of employment	Technicians								
					Engineering				
	Total	Computer programmer	Draftor	Science	Total	Electrical/ electronics	Mechanical	Civil	Other
Total manufacturing	585.9	91.6	108.7	92.4	293.3	149.7	40.3	3.1	100.3
DURABLE GOODS	457.8	73.4	100.7	18.2	265.5	144.5	35.1	3.1	82.8
Lumber and wood products	5.0	.4	3.9	.2	.5	-	.1	-	.4
Furniture and fixtures	4.9	.7	3.2	(2)	1.0	-	.2	-	.8
Stone, clay, and glass products	7.3	.9	2.2	1.5	2.8	.5	.5	.1	1.7
Primary metals	13.6	1.3	2.3	3.0	7.0	1.2	.9	-	4.9
Fabricated metal products	29.7	3.3	16.9	.6	8.9	1.7	2.5	-	4.7
Machinery, except electrical	118.1	36.0	28.1	1.8	52.2	32.0	8.5	.2	11.5
Electrical machinery	108.3	11.3	15.9	2.6	78.4	55.3	7.4	.5	15.2
Transportation equipment	85.0	12.3	16.8	2.2	53.7	13.4	8.3	2.4	29.6
Instruments	82.0	6.7	9.8	5.9	59.7	40.3	6.5	-	12.9
Miscellaneous manufacturing	3.8	.8	1.7	.1	1.2	-	.3	-	.9
NONDURABLE GOODS	128.2	18.1	8.0	74.2	27.8	5.2	5.1	-	17.5
Food and food products	16.7	2.7	-	11.0	2.9	-	.7	-	2.2
Tobacco products	1.0	-	-	.7	.3	-	-	-	.3
Textiles	4.9	1.0	-	1.9	2.1	-	.3	-	1.8
Apparel	2.4	.9	-	.1	1.4	-	.3	-	1.1
Paper and allied products	8.2	1.3	.9	2.5	3.5	.7	.5	.0	2.3
Printing and publishing	8.4	5.8	1.1	.2	1.3	-	.1	-	1.1
Chemicals	66.3	4.7	2.7	49.5	9.3	3.1	1.4	-	4.8
Refined petroleum products	8.0	.5	.7	4.7	2.2	.6	.4	-	1.2
Rubber and plastic products	11.8	1.0	2.6	3.5	4.6	.8	1.4	-	2.4
Leather products	.5	.3	-	.1	.1	-	(2)	-	.1

(1) Scientific, engineering, and technical
(2) Value is less than .05

NOTES: Because of rounding, components may not add to totals.
"-" = No amount available.

SOURCES: Occupational Employment Statistics Survey of the Bureau of Labor Statistics, and the National Science Foundation, SRS.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989

Meat products (SIC 2010)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,060	0.90	(1)
Scientists	840	.17	(1)
Computer analysts	360	.08	3.53
All other computer scientists	50	.01	(1)
Chemists	270	.06	1.99
All other physical scientists	40	(2)	(1)
Life scientists, unspecified	120	.02	3.56
Managers of scientific and technical personnel	520	.12	1.62
Engineers	990	.23	(1)
Industrial	380	.09	1.99
Mechanical	460	.11	4.25
Sales	20	(2)	(1)
Other, n.e.c	130	.03	(1)
Technicians	1,710	.38	(1)
Computer programmer	290	.07	2.20
Mechanical engineering technician	60	.01	(1)
Industrial engineering technicians	80	.01	15.61
All other engineering technicians	160	.03	(1)
Biological technicians	500	.12	5.65
Chemical technicians	480	.11	4.36
Petroleum technicians	140	.03	(1)

Dairy products (SIC 2020)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,840	2.91	(1)
Scientists	870	.51	(1)
Computer analysts	350	.21	3.49
All other computer scientists	40	.02	(1)
Chemists	330	.20	10.87
All other physical scientists	10	(2)	(1)
Life scientists, unspecified	140	.08	8.43
Managers of scientific and technical personnel	620	.38	4.86
Engineers	910	.55	(1)
Industrial	220	.13	4.04
Mechanical	420	.26	5.75
Sales	60	.03	34.73
Other, n.e.c	210	.13	(1)
Technicians	2,440	1.47	(1)
Computer programmer	310	.19	5.76
Mechanical engineering technician	30	.01	17.57
Industrial engineering technicians	30	.01	(1)
All other engineering technicians	160	.09	(1)
Biological technicians	1,150	.71	7.24
Chemical technicians	680	.42	10.69
Petroleum technicians	80	.04	(1)

Preserved fruits and vegetables (SIC 2030)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	6,390	2.61	(1)
Scientists	1,530	.62	(1)
Computer analysts	580	.24	6.46
All other computer scientists	40	.01	(1)
Chemists	330	.13	9.61
All other physical scientists	410	.17	(1)
Life scientists, unspecified	170	.07	.48
Managers of scientific and technical personnel	860	.36	4.04
Engineers	1,110	.45	(1)
Industrial	360	.15	5.48
Mechanical	500	.20	2.10
Other, n.e.c	250	.10	(1)
Technicians	2,890	1.18	(1)
Computer programmer	490	.20	8.87
Mechanical engineering technician	70	.02	(1)
Industrial engineering technicians	50	.02	(1)
All other engineering technicians	220	.09	(1)
Biological technicians	1,340	.56	1.68
Chemical technicians	540	.22	10.89
Petroleum technicians	180	.07	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Grain mill products (SIC 2040)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	5,240	4.09	(1)
Scientists	1,420	1.10	(1)
Computer analysts	560	.44	0.67
All other computer scientists	20	.01	(1)
Chemists	640	.51	4.44
All other physical scientists	100	.07	(1)
Life scientists, unspecified	100	.07	4.83
Managers of scientific and technical personnel	640	.51	1.84
Engineers	1,010	.79	(1)
Industrial	270	.21	2.11
Mechanical	440	.35	1.84
Sales	10	(2)	(1)
Other, n.e.c	290	.23	(1)
Technicians	2,170	1.69	(1)
Computer programmer	250	.19	3.80
Mechanical engineering technician	270	.21	(1)
Industrial engineering technicians	20	.01	(1)
All other engineering technicians	230	.18	(1)
Biological technicians	560	.44	4.22
Chemical technicians	690	.55	.94
Petroleum technicians	150	.11	(1)

Bakery products (SIC 2050)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,480	2.01	(1)
Scientists	990	.43	(1)
Computer analysts	530	.24	2.98
All other computer scientists	40	.01	(1)
Chemists	340	.15	1.18
All other physical scientists	50	.02	(1)
Life scientists, unspecified	30	.01	(1)
Managers of scientific and technical personnel	770	.36	1.29
Engineers	1,180	.54	(1)
Industrial	320	.15	1.51
Mechanical	460	.21	2.51
Other, n.e.c	400	.18	(1)
Technicians	1,540	.68	(1)
Computer programmer	420	.19	1.24
Mechanical engineering technician	20	(2)	(1)
Industrial engineering technicians	90	.04	(1)
All other engineering technicians	520	.24	(1)
Biological technicians	210	.09	(1)
Chemical technicians	200	.09	3.09
Petroleum technicians	80	.03	(1)

Sugar and confectionery products (SIC 2060)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,350	3.65	(1)
Scientists	780	.84	(1)
Computer analysts	250	.27	(1)
All other computer scientists	10	.01	(1)
Chemists	330	.36	6.30
All other physical scientists	40	.04	(1)
Life scientists, unspecified	150	.16	1.65
Managers of scientific and technical personnel	380	.42	1.41
Engineers	890	.97	(1)
Industrial	190	.21	4.51
Mechanical	430	.47	9.99
Sales	10	.01	44.36
Other, n.e.c	260	.28	(1)
Technicians	1,300	1.42	(1)
Computer programmer	120	.13	(1)
Mechanical engineering technician	100	.11	9.93
Industrial engineering technicians	30	.03	(1)
All other engineering technicians	130	.14	(1)
Biological technicians	290	.32	3.18
Chemical technicians	560	.62	.53
Petroleum technicians	70	.07	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Fats and oils (SIC 2070)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,530	4.77	(1)
Scientists	550	1.72	(1)
Computer analysts	230	.72	1.75
Chemists	260	.82	5.17
All other physical scientists	10	.03	(1)
Life scientists, unspecified	50	.15	(1)
Managers of scientific and technical personnel	120	.37	4.97
Engineers	180	.55	(1)
Industrial	50	.15	4.25
Mechanical	30	.09	2.88
Other, n.e.c	100	.31	(1)
Technicians	680	2.13	(1)
Computer programmer	150	.47	5.10
All other engineering technicians	20	.06	(1)
Biological technicians	130	.41	11.92
Chemical technicians	270	.85	3.12
Petroleum technicians	110	.34	(1)

Beverages (SIC 2080)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	6,840	3.39	(1)
Scientists	1,990	.99	(1)
Computer analysts	620	.31	2.54
All other computer scientists	50	.02	(1)
Chemists	980	.49	10.09
All other physical scientists	160	.08	(1)
Life scientists, unspecified	180	.09	3.47
Managers of scientific and technical personnel	770	.38	3.58
Engineers	1,580	.79	(1)
Industrial	300	.15	2.78
Mechanical	560	.28	1.62
Sales	20	.01	8.18
Other, n.e.c	700	.35	(1)
Technicians	2,500	1.23	(1)
Computer programmer	390	.19	4.14
Mechanical engineering technician	50	.02	(1)
Industrial engineering technicians	80	.04	(1)
All other engineering technicians	250	.12	(1)
Biological technicians	260	.13	11.03
Chemical technicians	980	.49	7.22
Petroleum technicians	490	.24	(1)

Misc. food and kindred products (SIC 2090)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,210	2.23	(1)
Scientists	970	.50	(1)
Computer analysts	540	.29	(1)
All other computer scientists	40	.02	(1)
Chemists	210	.11	6.28
All other physical scientists	90	.04	(1)
Life scientists, unspecified	90	.04	(1)
Managers of scientific and technical personnel	630	.34	1.55
Engineers	1,170	.63	(1)
Industrial	500	.27	(1)
Mechanical	420	.23	2.72
Other, n.e.c	250	.13	(1)
Technicians	1,440	.76	(1)
Computer programmer	290	.15	1.81
Mechanical engineering technician	80	.04	(1)
Industrial engineering technicians	40	.02	(1)
All other engineering technicians	130	.07	(1)
Biological technicians	630	.34	5.10
Chemical technicians	240	.13	1.60
Petroleum technicians	30	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Cigarettes (SIC 2110)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,930	10.14	(1)
Scientists	1,470	3.78	(1)
Computer analysts	560	1.45	(1)
All other computer scientists	260	.67	(1)
Chemists	520	1.34	(1)
All other physical scientists	50	.12	(1)
Life scientists, unspecified	80	.20	(1)
Managers of scientific and technical personnel	360	.93	(1)
Engineers	1,130	2.92	(1)
Industrial	80	.20	(1)
Other, n.e.c	1,050	2.72	(1)
Technicians	970	2.51	(1)
All other engineering technicians	290	.75	(1)
Chemical technicians	470	1.22	(1)
Petroleum technicians	210	.54	(1)

Cigars (SIC 2120)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	20	0.62	(1)
Engineers	20	.62	(1)
Industrial	10	.31	(1)
Mechanical	10	.31	12.29
Technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)

Chewing and smoking tobacco (SIC 2130)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	60	2.35	(1)
Scientists	20	.78	(1)
All other computer scientists	10	.39	(1)
Chemists	10	.39	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	(2)	(2)	(1)
Engineers	10	.39	(1)
Industrial	(2)	(2)	(1)
Mechanical	10	.39	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	30	1.18	(1)
Computer programmer	(2)	(2)	(1)
Petroleum technicians	30	1.18	(1)

Tobacco stemming and redrying (SIC 2140)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	50	1.15	(1)
Scientists	30	.69	(1)
All other computer scientists	20	.46	(1)
Chemists	10	.23	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	10	.23	(1)
Engineers	10	.23	(1)
Mechanical	10	.23	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)
Petroleum technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Broadwoven fabric mills, cotton (SIC 2210)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,570	1.57	(1)
Scientists	300	.30	(1)
Computer analysts	210	.21	(1)
All other computer scientists	10	.01	(1)
Chemists	70	.07	10.39
All other physical scientists	10	.01	(1)
Managers of scientific and technical personnel	150	.15	(1)
Engineers	470	.47	(1)
Industrial	290	.29	(1)
Mechanical	150	.15	(1)
Other, n.e.c	30	.03	(1)
Technicians	650	.65	(1)
Computer programmer	160	.16	(1)
Mechanical engineering technician	30	.03	(1)
Industrial engineering technicians	250	.25	(1)
All other engineering technicians	60	.06	(1)
Chemical technicians	130	.13	5.89
Petroleum technicians	20	.02	(1)

Broadwoven fabric mills, manmade (SIC 2220)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,350	2.71	(1)
Scientists	650	.75	(1)
Computer analysts	450	.52	0.64
All other computer scientists	80	.09	(1)
Chemists	120	.14	5.99
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	380	.44	.77
Engineers	630	.73	(1)
Industrial	360	.42	1.53
Mechanical	190	.22	(1)
Other, n.e.c	80	.09	(1)
Technicians	690	.79	(1)
Computer programmer	190	.22	1.62
Mechanical engineering technician	20	.02	(1)
Industrial engineering technicians	170	.19	1.62
All other engineering technicians	120	.14	(1)
Chemical technicians	180	.21	8.50
Petroleum technicians	10	.01	(1)

Broadwoven fabric mills, wool (SIC 2230)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	420	2.10	(1)
Scientists	60	.30	(1)
Computer analysts	20	.10	(1)
Chemists	40	.20	4.00
Managers of scientific and technical personnel	60	.30	7.86
Engineers	160	.80	(1)
Industrial	50	.25	1.71
Mechanical	30	.15	(1)
Sales	50	.25	8.31
Other, n.e.c	30	.15	(1)
Technicians	140	.70	(1)
Computer programmer	30	.15	2.62
Industrial engineering technicians	40	.20	(1)
All other engineering technicians	30	.15	(1)
Chemical technicians	40	.20	10.98

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Narrow fabric mills (SIC 2240)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	270	1.08	(1)
Scientists	40	.16	(1)
Computer analysts	10	.04	(1)
All other computer scientists	(2)	(2)	(1)
Chemists	20	.08	(1)
All other physical scientists	10	.04	(1)
Managers of scientific and technical personnel	30	.12	5.81
Engineers	100	.40	(1)
Industrial	40	.16	5.71
Mechanical	40	.16	13.52
Other, n.e.c	20	.08	(1)
Technicians	100	.40	(1)
Computer programmer	20	.08	13.57
Industrial engineering technicians	20	.08	(1)
All other engineering technicians	20	.08	(1)
Chemical technicians	30	.12	(1)
Petroleum technicians	10	.04	(1)

Knitting mills (SIC 2250)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,960	0.84	(1)
Scientists	310	.12	(1)
Computer analysts	190	.08	(1)
All other computer scientists	30	.01	(1)
Chemists	70	.03	3.88
All other physical scientists	10	(2)	(1)
Life scientists, unspecified	10	(2)	(1)
Managers of scientific and technical personnel	200	.09	1.61
Engineers	500	.22	(1)
Industrial	380	.17	4.75
Mechanical	70	.03	(1)
Other, n.e.c	50	.02	(1)
Technicians	950	.41	(1)
Computer programmer	280	.12	2.34
Mechanical engineering technician	20	(2)	(1)
Industrial engineering technicians	260	.12	4.94
All other engineering technicians	130	.06	(1)
Chemical technicians	250	.11	9.70
Petroleum technicians	10	(2)	(1)

Textile finishing, except wool (SIC 2260)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,240	2.02	(1)
Scientists	340	.55	(1)
Computer analysts	100	.16	12.81
All other computer scientists	(2)	(2)	(1)
Chemists	190	.31	6.58
All other physical scientists	50	.08	(1)
Managers of scientific and technical personnel	80	.13	5.76
Engineers	220	.36	(1)
Industrial	120	.20	1.97
Mechanical	70	.11	(.77
Other, n.e.c	30	.05	(1)
Technicians	600	.98	(1)
Computer programmer	100	.16	13.03
Mechanical engineering technician	(2)	(2)	(1)
Industrial engineering technicians	60	.10	(1)
All other engineering technicians	30	.05	(1)
Chemical technicians	370	.61	4.23
Petroleum technicians	40	.06	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Carpets and rugs (SIC 2270)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,110	1.72	(1)
Scientists	290	.45	(1)
Computer analysts	190	.30	0.98
All other computer scientists	40	.06	(1)
Chemists	60	.09	10.96
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	140	.22	6.29
Engineers	270	.42	(1)
Industrial	169	.25	(1)
Mechanical	90	.14	4.83
Other, n.e.c.	20	.03	(1)
Technicians	410	.53	(1)
Computer programmer	100	.16	7.77
Mechanical engineering technician	10	.01	(1)
Industrial engineering technicians	80	.12	(1)
All other engineering technicians	40	.06	(1)
Chemical technicians	160	.25	23.53
Petroleum technicians	20	.03	(1)

Yarn and thread mills (SIC 2280)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,160	1.01	(1)
Scientists	100	.07	(1)
Computer analysts	50	.04	8.94
All other computer scientists	10	(2)	(1)
Chemists	40	.03	(1)
Managers of scientific and technical personnel	90	.08	6.96
Engineers	430	.39	(1)
Industrial	300	.28	9.15
Mechanical	110	.10	4.85
Other, n.e.c.	20	.01	(1)
Technicians	540	.47	(1)
Computer programmer	50	.04	1.74
Mechanical engineering technician	110	.10	(1)
Industrial engineering technicians	290	.27	4.27
All other engineering technicians	30	.02	(1)
Chemical technicians	50	.04	(1)
Petroleum technicians	10	(2)	(1)

Misc. textile goods (SIC 2290)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,820	3.37	(1)
Scientists	280	.51	(1)
Computer analysts	80	.15	3.33
All other computer scientists	(2)	(2)	(1)
Chemists	150	.28	3.68
All other physical scientists	30	.05	(1)
Life scientists, unspecified	20	.03	(1)
Managers of scientific and technical personnel	190	.36	6.30
Engineers	490	.90	(1)
Industrial	150	.28	4.09
Mechanical	200	.37	1.21
Sales	40	.07	13.14
Other, n.e.c.	100	.18	(1)
Technicians	860	1.60	(1)
Computer programmer	50	.09	2.31
Mechanical engineering technician	70	.13	2.46
Industrial engineering technicians	60	.11	(1)
All other engineering technicians	150	.28	(1)
Chemical technicians	510	.96	5.28
Petroleum technicians	20	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Men's and boys' suits and coats (SIC 2310)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	320	0.55	(1)
Scientists	50	.09	(1)
Computer analysts	50	.09	2.00
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	50	.09	(1)
Engineers	110	.18	(1)
Industrial	90	.16	1.63
Mechanical	10	.01	(1)
Other, n.e.c	10	.01	(1)
Technicians	110	.19	(1)
Computer programmer	50	.09	3.19
Industrial engineering technicians	50	.09	(1)
All other engineering technicians	10	.01	(1)
Petroleum technicians	(2)	(2)	(1)

Men's and boys' furnishings (SIC 2320)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,630	0.51	(1)
Scientists	210	.06	(1)
Computer analysts	170	.05	5.80
All other computer scientists	40	.01	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	180	.06	6.31
Engineers	650	.21	(1)
Industrial	500	.17	8.39
Mechanical	130	.04	36.32
Other, n.e.c	20	(2)	(1)
Technicians	590	.18	(1)
Computer programmer	250	.08	8.24
Mechanical engineering technician	90	.03	68.10
Industrial engineering technicians	190	.06	8.62
All other engineering technicians	50	.01	(1)
Petroleum technicians	10	(2)	(1)

Women's and misses' outerwear (SIC 2330)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,310	0.33	(1)
Scientists	260	.06	(1)
Computer analysts	200	.05	8.44
All other computer scientists	50	.01	(1)
All other physical scientists	10	(2)	(1)
Managers of scientific and technical personnel	210	.06	5.25
Engineers	410	.10	(1)
Industrial	310	.08	5.45
Mechanical	50	.01	19.73
Other, n.e.c	50	.01	(1)
Technicians	430	.11	(1)
Computer programmer	220	.06	8.89
Mechanical engineering technician	10	(2)	32.00
Industrial engineering technicians	150	.04	7.84
All other engineering technicians	40	.01	(1)
Petroleum technicians	10	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Women's and children's undergarments (SIC 2340)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	590	0.81	(1)
Scientists	60	.08	(1)
Computer analysts	50	.07	11.43
All other computer scientists	10	.01	(1)
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	90	.13	20.94
Engineers	200	.27	(1)
Industrial	150	.21	2.52
Mechanical	40	.05	7.81
Other, n.e.c	10	.01	(1)
Technicians	240	.33	(1)
Computer programmer	90	.13	7.83
Industrial engineering technicians	120	.17	5.21
All other engineering technicians	20	.02	(1)
Chemical technicians	10	.01	(1)

Hats, caps, and millinery (SIC 2350)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	50	0.32	(1)
Scientists	20	.13	(1)
All other computer scientists	20	.13	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	10	.06	(1)
Engineers	20	.13	(1)
Industrial	20	.13	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	(2)	(2)	(1)
Industrial engineering technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)

Girls' and children's outerwear (SIC 2360)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	430	0.70	(1)
Scientists	60	.09	(1)
Computer analysts	30	.05	(1)
All other computer scientists	20	.03	(1)
All other physical scientists	10	.01	(1)
Managers of scientific and technical personnel	40	.06	11.86
Engineers	160	.27	(1)
Industrial	130	.22	4.03
Mechanical	30	.05	5.55
Other, n.e.c	(2)	(2)	(1)
Technicians	170	.28	(1)
Computer programmer	50	.08	3.02
Industrial engineering technicians	100	.17	4.66
All other engineering technicians	20	.03	(1)

Fur goods (SIC 2370)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	(2)	(2)	(1)
Scientists	(2)	(2)	(1)
All other computer scientists	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Misc. apparel and accessories (SIC 2380)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	180	0.36	(1)
Scientists	20	.04	(1)
Computer analysts	10	.02	27.94
All other computer scientists	10	.02	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	40	.08	8.57
Engineers	50	.10	(1)
Industrial	30	.06	(1)
Mechanical	20	.04	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	70	.14	(1)
Computer programmer	30	.06	11.03
Industrial engineering technicians	20	.04	(1)
All other engineering technicians	10	.02	(1)
Petroleum technicians	10	.02	(1)

Misc. fabricated textile products (SIC 2390)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,490	1.14	(1)
Scientists	170	.06	(1)
Computer analysts	120	.05	5.02
All other computer scientists	30	.01	(1)
Chemists	20	(2)	(1)
Managers of scientific and technical personnel	380	.18	9.30
Engineers	1,130	.54	(1)
Industrial	410	.20	1.89
Mechanical	430	.21	6.70
Sales	90	.04	7.31
Other, n.e.c	200	.09	(1)
Technicians	810	.36	(1)
Computer programmer	220	.10	4.32
Mechanical engineering technician	200	.09	8.31
Industrial engineering technicians	110	.05	5.35
All other engineering technicians	260	.12	(1)
Chemical technicians	20	(2)	(1)
Petroleum technicians	(2)	(2)	(1)

Logging (SIC 2410)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	610	0.71	(1)
Scientists	550	.65	(1)
All other computer scientists	(2)	(2)	(1)
Foresters and conservation scientists	550	.65	5.86
All other life scientists	(2)	(2)	(1)
Engineers	30	.03	(1)
Other, n.e.c	30	.03	(1)
Technicians	30	.03	(1)
All other engineering technicians	30	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Sawmills and planing mills (SIC 2420)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,110	0.93	(1)
Scientists	1,000	.47	(1)
Computer analysts	160	.07	11.63
All other computer scientists	20	(2)	(1)
Foresters and conservation scientists	810	.40	24.99
All other life scientists	10	(2)	(1)
Managers of scientific and technical personnel	200	.09	5.00
Engineers	500	.21	(1)
Industrial	60	.02	4.92
Mechanical	100	.04	4.55
Sales	20	(2)	12.73
Other, n.e.c	320	.15	(1)
Technicians	410	.16	(1)
Computer programmer	80	.03	10.15
Drafter	100	.04	11.78
Mechanical engineering technician	10	(2)	(1)
Industrial engineering technicians	20	(2)	12.00
All other engineering technicians	30	.01	(1)
Physical and life science technicians, unspec	170	.08	(1)

Millwork, plywood, and structural members (SIC 2430)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,430	1.55	(1)
Scientists	320	.10	(1)
Computer analysts	200	.07	4.12
All other computer scientists	20	(2)	(1)
Foresters and conservation scientists	100	.03	6.67
Managers of scientific and technical personnel	340	.12	2.96
Engineers	720	.24	(1)
Industrial	290	.10	4.17
Mechanical	270	.09	3.01
Sales	60	.02	10.97
Other, n.e.c	100	.03	(1)
Technicians	3,050	1.09	(1)
Computer programmer	190	.06	3.90
Drafter	2,560	.94	3.51
Mechanical engineering technician	40	.01	8.95
Industrial engineering technicians	80	.02	(1)
All other engineering technicians	150	.05	(1)
Physical and life science technicians, unspec	30	.01	(1)

Wood containers (SIC 2440)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	60	0.12	(1)
Scientists	(2)	(2)	(1)
Computer analysts	(2)	(2)	(1)
All other computer scientists	(2)	(2)	(1)
All other life scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	10	.02	(1)
Engineers	20	.04	(1)
Industrial	10	.02	30.00
Other, n.e.c	10	.02	(1)
Technicians	30	.06	(1)
Computer programmer	10	.02	(1)
Drafter	20	.04	23.08
Industrial engineering technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Wood buildings and mobile homes (SIC 2450)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,440	2.15	(1)
Scientists	30	.04	(1)
Computer analysts	30	.04	(1)
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	140	.21	4.23
Engineers	110	.16	(1)
Industrial	40	.06	9.44
Mechanical	20	.03	12.65
Sales	40	.06	12.82
Other, n.e.c	10	.01	(1)
Technicians	1,160	1.74	(1)
Computer programmer	20	.03	12.63
Drafter	1,060	1.60	3.94
Mechanical engineering technician	30	.04	24.14
All other engineering technicians	50	.07	(1)

Misc. wood products (SIC 2490)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	870	0.92	(1)
Scientists	110	.11	(1)
Computer analysts	70	.07	8.61
All other computer scientists	(2)	(2)	(1)
Foresters and conservation scientists	40	.04	9.98
All other life scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	110	.12	4.41
Engineers	340	.37	(1)
Industrial	100	.11	2.47
Mechanical	160	.18	.38
Sales	10	.01	(1)
Other, n.e.c	70	.07	(1)
Technicians	310	.32	(1)
Computer programmer	60	.06	2.67
Drafter	120	.13	15.58
Mechanical engineering technician	10	.01	(1)
Industrial engineering technicians	40	.04	(1)
All other engineering technicians	40	.04	(1)
Physical and life science technicians, unspec	40	.04	7.03

Household furniture (SIC 2510)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,740	0.82	(1)
Scientists	290	.08	(1)
Computer analysts	250	.08	9.35
All other computer scientists	30	(2)	(1)
All other life scientists	10	(2)	(1)
Managers of scientific and technical personnel	480	.15	6.17
Engineers	850	.26	(1)
Industrial	560	.18	5.16
Mechanical	200	.06	6.03
Sales	20	(2)	22.25
Other, n.e.c	70	.02	(1)
Technicians	1,120	.33	(1)
Computer programmer	300	.09	12.59
Drafter	510	.16	8.32
Mechanical engineering technician	20	(2)	(1)
Industrial engineering technicians	170	.05	4.53
All other engineering technicians	120	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Office furniture (SIC 2520)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	2,180	2.99	(1)
Scientists	220	.30	(1)
Computer analysts	160	.22	(1)
All other computer scientists	60	.08	(1)
Managers of scientific and technical personnel	360	.50	2.46
Engineers	780	1.07	(1)
Industrial	260	.36	.68
Mechanical	270	.37	.67
Sales	20	.02	(1)
Other, n.e.c	230	.32	(1)
Technicians	820	1.12	(1)
Computer programmer	110	.15	(1)
Drafter	480	.67	3.26
Mechanical engineering technician	60	.08	7.37
Industrial engineering technicians	80	.11	(1)
All other engineering technicians	70	.09	(1)
Physical and life science technicians, unspec	20	.02	(1)

Public building & related furniture (SIC 2530)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	1,110	3.19	(1)
Scientists	40	.11	(1)
Computer analysts	40	.11	2.11
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	120	.35	1.35
Engineers	450	1.30	(1)
Industrial	130	.38	1.48
Mechanical	220	.64	2.17
Sales	20	.05	(1)
Other, n.e.c	80	.23	(1)
Technicians	500	1.43	(1)
Computer programmer	60	.17	(1)
Drafter	280	.82	5.12
Mechanical engineering technician	30	.08	(1)
Industrial engineering technicians	40	.11	(1)
All other engineering technicians	80	.23	(1)
Physical and life science technicians, unspec	10	.02	(1)

Partitions and fixtures (SIC 2540)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	3,120	3.89	(1)
Scientists	140	.17	(1)
Computer analysts	120	.15	(1)
All other computer scientists	20	.02	(1)
Managers of scientific and technical personnel	260	.32	2.36
Engineers	810	1.01	(1)
Industrial	200	.25	.50
Mechanical	340	.43	.91
Sales	200	.25	1.22
Other, n.e.c	70	.08	(1)
Technicians	1,910	2.39	(1)
Computer programmer	130	.16	1.20
Drafter	1,570	1.98	1.08
Mechanical engineering technician	60	.07	1.70
Industrial engineering technicians	60	.07	1.70
All other engineering technicians	90	.11	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Misc. furniture and fixtures (SIC 2590)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,160	3.16	(1)
Scientists	130	.35	(1)
Computer analysts	110	.30	(1)
All other computer scientists	20	.05	(1)
Managers of scientific and technical personnel	120	.33	1.61
Engineers	400	1.09	(1)
Industrial	150	.41	(1)
Mechanical	160	.44	2.61
Sales	40	.11	(1)
Other, n.e.c	50	.13	(1)
Technicians	510	1.39	(1)
Computer programmer	70	.19	(1)
Drafter	350	.96	3.93
Mechanical engineering technician	20	.05	(1)
Industrial engineering technicians	30	.08	(1)
All other engineering technicians	40	.11	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

Pulp mills (SIC 2610)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,330	7.98	(1)
Scientists	330	1.98	(1)
Computer analysts	120	.72	(1)
All other computer scientists	10	.06	(1)
Chemists	160	.96	(1)
All other physical scientists	20	.12	(1)
Life scientists, unspecified	20	.12	(1)
Managers of scientific and technical personnel	120	.72	(1)
Engineers	440	2.64	(1)
Chemical	130	.78	(1)
Electrical/electronic	80	.48	(1)
Computer	60	.36	(1)
Industrial	50	.30	(1)
Mechanical	100	.60	(1)
Other, n.e.c	20	.12	(1)
Technicians	440	2.64	(1)
Computer programmer	40	.24	(1)
Drafter	30	.18	(1)
Mechanical engineering technician	40	.24	(1)
All other engineering technicians	220	1.32	(1)
Chemical technicians	80	.48	(1)
Petroleum technicians	30	.18	(1)

Paper mills (SIC 2620)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	8,560	4.77	(1)
Scientists	1,030	.56	(1)
Computer analysts	500	.28	(1)
All other computer scientists	30	.01	(1)
Chemists	360	.20	(1)
All other physical scientists	120	.06	(1)
Life scientists, unspecified	20	.01	(1)
Managers of scientific and technical personnel	720	.41	0.17
Engineers	3,850	2.15	(1)
Chemical	950	.54	(1)
Electrical/electronic	560	.31	1.38
Computer	200	.11	(1)
Industrial	710	.40	(1)
Mechanical	1,010	.57	(1)
Sales	70	.03	(1)
Other, n.e.c	350	.19	(1)
Technicians	2,960	1.65	(1)
Computer programmer	670	.38	(1)
Drafter	290	.16	(1)
Electrical/electronic technicians	330	.18	(1)
Mechanical engineering technician	150	.08	(1)
Industrial engineering technicians	170	.09	(1)
All other engineering technicians	230	.13	(1)
Chemical technicians	970	.55	(1)
Petroleum technicians	150	.08	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Paperboard mills (SIC 2630)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,310	4.37	(1)
Scientists	320	.59	(1)
Computer analysts	130	.25	(1)
All other computer scientists	10	.01	(1)
Chemists	60	.11	(1)
All other physical scientists	40	.07	(1)
Life scientists, unspecified	80	.15	(1)
Managers of scientific and technical personnel	150	.29	(1)
Engineers	1,140	2.18	(1)
Chemical	280	.54	0.35
Electrical/electronic	150	.29	(1)
Computer	70	.13	(1)
Industrial	140	.27	(1)
Mechanical	340	.65	.30
Other, n.e.c	160	.30	(1)
Technicians	700	1.31	(1)
Computer programmer	100	.19	(1)
Drafter	120	.23	(1)
Electrical/electronic technicians	40	.07	(1)
Mechanical engineering technician	50	.09	(1)
Industrial engineering technicians	20	.03	(1)
All other engineering technicians	140	.27	(1)
Chemical technicians	210	.40	(1)
Petroleum technicians	20	.03	(1)

Paperboard containers and boxes (SIC 2650)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,390	1.04	(1)
Scientists	350	.14	(1)
Computer analysts	240	.11	6.96
All other computer scientists	30	.01	(1)
Chemists	10	(2)	(1)
All other physical scientists	30	.01	(1)
Life scientists, unspecified	40	.01	40.00
Managers of scientific and technical personnel	340	.16	11.39
Engineers	1,080	.48	(1)
Chemical	40	.01	(1)
Electrical/electronic	50	.02	12.80
Computer	30	.01	24.27
Industrial	280	.13	3.92
Mechanical	310	.14	6.14
Sales	130	.06	12.51
Other, n.e.c	240	.11	(1)
Technicians	620	.26	(1)
Computer programmer	170	.08	5.44
Drafter	190	.09	11.23
Electrical/electronic technicians	70	.03	14.06
Mechanical engineering technician	30	.01	23.03
Industrial engineering technicians	40	.01	23.87
All other engineering technicians	70	.03	(1)
Chemical technicians	20	(2)	(1)
Petroleum technicians	30	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Misc. converted paper products (SIC 2670)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	11,940	4.87	(1)
Scientists	2,190	.89	(1)
All other computer scientists	1,290	.53	(1)
All other physical scientists	830	.34	(1)
Life scientists, unspecified	70	.02	(1)
Managers of scientific and technical personnel	1,510	.62	1.04
Engineers	4,800	1.97	(1)
Chemical	410	.17	5.81
Electrical/electronic	290	.12	2.54
Computer	110	.04	2.20
Industrial	430	.17	2.19
Mechanical	700	.29	2.07
Sales	60	.02	11.91
Other, n.e.c	2,800	1.16	(1)
Technicians	3,440	1.39	(1)
Computer programmer	340	.14	4.77
Drafter	240	.09	5.15
Electrical/electronic technicians	220	.09	(1)
Mechanical engineering technician	240	.09	(1)
Industrial engineering technicians	110	.04	4.30
All other engineering technicians	1,320	.54	(1)
Chemical technicians	410	.17	8.63
Petroleum technicians	560	.23	(1)

Newspapers (SIC 2710)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,350	0.86	(1)
Scientists	1,700	.35	(1)
Computer analysts	1,350	.28	2.00
All other compater scientists	340	.07	(1)
Life scientists, unspecified	10	(2)	77.50
Managers of scientific and technical personnel	820	.17	4.35
Engineers	350	.05	(1)
Industrial	70	.01	4.87
Mechanical	90	.01	(1)
Sales	80	.01	39.88
Other, n.e.c	110	.02	(1)
Technicians	1,480	.29	(1)
Computer programmer	1,170	.24	5.76
Drafter	20	(2)	15.00
Mechanical engineering technician	20	(2)	(1)
All other engineering technicians	270	.05	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

Periodicals (SIC 2720)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,420	2.66	(1)
Scientists	1,330	1.05	(1)
Computer analysts	1,070	.85	1.62
All other computer scientists	120	.09	(1)
Life scientists, unspecified	140	.11	(1)
Managers of scientific and technical personnel	430	.34	2.12
Engineers	100	.06	(1)
Industrial	30	.02	(1)
Mechanical	40	.03	(1)
Sales	20	.01	(1)
Other, n.e.c	10	(2)	(1)
Technicians	1,560	1.21	(1)
Computer programmer	1,100	.87	6.89
Drafter	110	.08	11.74
Industrial engineering technicians	20	.01	(1)
All other engineering technicians	270	.21	(1)
Physical and life science technicians, unspec	60	.04	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Books (SIC 2730)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,910	2.38	(1)
Scientists	1,350	1.12	(1)
Computer analysts	1,250	1.04	1.03
All other computer scientists	100	.08	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	480	.40	2.35
Engineers	160	.12	(1)
Industrial	80	.06	(1)
Mechanical	60	.05	(1)
Other, n.e.c	20	.01	(1)
Technicians	920	.74	(1)
Computer programmer	780	.65	4.04
Drafter	20	.01	4.71
Industrial engineering technicians	10	(2)	(1)
All other engineering technicians	90	.07	(1)
Physical and life science technicians, unspec	20	.01	(1)

Misc. publishing (SIC 2740)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,830	3.39	(1)
Scientists	770	.92	(1)
Computer analysts	720	.87	0.39
All other computer scientists	20	.02	(1)
Life scientists, unspecified	30	.03	(1)
Managers of scientific and technical personnel	340	.41	.89
Engineers	260	.30	(1)
Industrial	30	.03	(1)
Mechanical	20	.02	3.64
Other, n.e.c	210	.25	(1)
Technicians	1,460	1.76	(1)
Computer programmer	900	1.09	4.52
Drafter	450	.54	8.84
Industrial engineering technicians	10	.01	(1)
All other engineering technicians	100	.12	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

Commercial printing (SIC 2750)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	4,320	0.74	(1)
Scientists	1,020	.18	(1)
Computer analysts	950	.17	9.93
All other computer scientists	70	.01	(1)
Managers of scientific and technical personnel	640	.11	5.52
Engineers	840	.15	(1)
Industrial	220	.04	9.43
Mechanical	280	.05	5.51
Sales	110	.02	11.66
Other, n.e.c	230	.04	(1)
Technicians	1,820	.30	(1)
Computer programmer	1,110	.20	5.01
Drafter	370	.06	9.52
Mechanical engineering technician	90	.01	10.01
Industrial engineering technicians	90	.01	(1)
All other engineering technicians	120	.02	(1)
Physical and life science technicians, unspec	40	(2)	27.64

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Manifold business forms (SIC 2760)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	920	1.73	(1)
Scientists	200	.38	(1)
Computer analysts	190	.37	1.47
All other computer scientists	10	.01	(1)
Managers of scientific and technical personnel	150	.29	.94
Engineers	260	.49	(1)
Industrial	70	.13	1.10
Mechanical	50	.09	(1)
Other, n.e.c	140	.27	(1)
Technicians	310	.57	(1)
Computer programmer	170	.33	1.69
Drafter	20	.03	(1)
Industrial engineering technicians	10	.01	(1)
All other engineering technicians	20	.03	(1)
Physical and life science technicians, unspec	90	.17	(1)

Greeting cards (SIC 2770)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	1,220	5.03	(1)
Scientists	840	3.48	(1)
All other computer scientists	820	3.40	(1)
Life scientists, unspecified	20	.08	(1)
Managers of scientific and technical personnel	50	.20	1.70
Engineers	250	1.03	(1)
Industrial	90	.37	(1)
Other, n.e.c	160	.66	(1)
Technicians	80	.32	(1)
Industrial engineering technicians	10	.04	(1)
All other engineering technicians	50	.20	(1)
Physical and life science technicians, unspec	20	.08	(1)

Blankbooks and bookbinding (SIC 2780)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	720	0.89	(1)
Scientists	150	.18	(1)
Computer analysts	120	.15	(1)
All other computer scientists	30	.03	(1)
Managers of scientific and technical personnel	100	.13	(1)
Engineers	160	.19	(1)
Industrial	60	.07	(1)
Mechanical	80	.10	(1)
Other, n.e.c	20	.02	(1)
Technicians	310	.39	(1)
Computer programmer	230	.30	7.34
Drafter	40	.05	4.65
Mechanical engineering technician	10	.01	(1)
Industrial engineering technicians	10	.01	(1)
All other engineering technicians	20	.02	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Printing trade services (SIC 2790)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	890	1.33	(1)
Scientists	240	.36	(1)
Computer analysts	170	.26	1.86
All other computer scientists	70	.10	(1)
Managers of scientific and technical personnel	80	.12	1.48
Engineers	100	.14	(1)
Industrial	10	.01	(1)
Mechanical	40	.06	(1)
Sales	20	.03	(1)
Other, n.e.c	30	.04	(1)
Technicians	470	.71	(1)
Computer programmer	360	.56	6.72
Drafter	70	.10	8.45
Mechanical engineering technician	10	.01	(1)
All other engineering technicians	30	.04	(1)

Industrial inorganic chemicals (SIC 2810)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	23,520	16.84	(1)
Scientists	5,390	3.84	(1)
Computer analysts	960	.69	2.03
All other computer scientists	40	.02	(1)
Mathematical scientists	70	.05	8.60
Chemists	3,280	2.36	5.19
All other physical scientists	590	.42	(1)
Biological scientists	180	.12	2.34
Medical scientists	10	(2)	(1)
All other life scientists	260	.18	(1)
Managers of scientific and technical personnel	1,540	1.11	3.71
Engineers	9,750	6.99	(1)
Chemical	3,430	2.47	3.43
Civil	310	.22	1.20
Electrical/electronic	1,030	.74	.61
Computer	290	.20	1.93
Industrial	490	.35	.98
Mechanical	1,920	1.38	1.38
Metallurgists/metallurgical	280	.20	8.20
Safety	300	.21	2.44
Sales	280	.20	6.21
Other, n.e.c	1,420	1.02	(1)
Technicians	6,840	4.90	(1)
Computer programmer	450	.32	3.09
Drafter	580	.41	2.00
Electrical/electronic technicians	460	.33	.41
Mechanical engineering technician	100	.07	2.44
Industrial engineering technicians	70	.05	4.18
All other engineering technicians	520	.37	(1)
Biological technicians	160	.11	(1)
Chemical technicians	3,820	2.75	1.97
Petroleum technicians	680	.49	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Plastics materials and synthetics (SIC 2820)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	32,370	16.73	(1)
Scientists	7,160	3.70	(1)
Computer analysts	1,620	.84	0.29
All other computer scientists	840	.43	(1)
Mathematical scientists	40	.02	(1)
Chemists	3,890	2.02	1.52
All other physical scientists	320	.16	(1)
Medical scientists	20	.01	(1)
All other life scientists	430	.22	(1)
Managers of scientific and technical personnel	1,850	.96	.92
Engineers	11,260	5.81	(1)
Chemical	4,510	2.34	.69
Civil	360	.18	.45
Electrical/electronic	1,110	.57	.35
Computer	320	.16	1.31
Industrial	490	.25	2.87
Mechanical	2,310	1.20	.70
Metallurgists/metallurgical	20	.01	(1)
Safety	300	.15	1.21
Sales	810	.42	.63
Other, n.e.c	1,030	.53	(1)
Technicians	12,100	6.26	(1)
Computer programmer	630	.32	.55
Drafter	720	.37	.52
Electrical/electronic technicians	670	.34	1.78
Mechanical engineering technician	280	.14	3.67
Industrial engineering technicians	80	.04	4.00
All other engineering technicians	1,270	.66	(1)
Biological technicians	240	.12	1.73
Chemical technicians	7,660	3.99	1.24
Petroleum technicians	550	.28	(1)

Drugs (SIC 2830)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	55,080	21.46	(1)
Scientists	28,730	11.22	(1)
Computer analysts	3,210	1.25	0.26
All other computer scientists	590	.23	(1)
Mathematical scientists	480	.18	5.79
Chemists	8,740	3.42	2.30
All other physical scientists	420	.16	(1)
Biological scientists	9,900	3.88	2.15
Medical scientists	3,670	1.43	3.73
All other life scientists	1,720	.67	(1)
Managers of scientific and technical personnel	4,700	1.84	1.37
Engineers	4,910	1.88	(1)
Chemical	1,360	.53	1.27
Civil	300	.11	1.66
Electrical/electronic	210	.08	1.55
Computer	320	.12	8.28
Industrial	980	.38	.83
Mechanical	730	.28	3.38
Metallurgists/metallurgical	20	(2)	8.89
Safety	260	.10	1.16
Sales	60	.02	8.84
Other, n.e.c	670	.26	(1)
Technicians	16,740	6.52	(1)
Computer programmer	1,490	.58	.75
Drafter	350	.13	.92
Electrical/electronic technicians	630	.24	.74
Mechanical engineering technician	490	.19	9.19
Industrial engineering technicians	140	.05	(1)
All other engineering technicians	220	.08	(1)
Biological technicians	4,240	1.66	4.33
Chemical technicians	7,730	3.03	2.97
Petroleum technicians	1,450	.56	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Soap, cleaners, and toilet goods (SIC 2840)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	14,760	8.67	(1)
Scientists	5,980	3.54	(1)
Computer analysts	960	.57	1.53
All other computer scientists	230	.13	(1)
Mathematical scientists	30	.01	(1)
Chemists	3,960	2.36	5.28
All other physical scientists	70	.04	(1)
Biological scientists	470	.28	5.51
Medical scientists	40	.02	(1)
All other life scientists	220	.13	(1)
Managers of scientific and technical personnel	1,680	1.00	5.12
Engineers	2,580	1.49	(1)
Chemical	810	.48	4.72
Civil	40	.02	22.71
Electrical/electronic	110	.06	4.94
Computer	90	.05	7.52
Industrial	460	.27	2.96
Mechanical	360	.21	14.03
Safety	80	.04	7.39
Sales	110	.06	37.01
Other, n.e.c.	520	.30	(1)
Technicians	4,520	2.66	(1)
Computer programmer	700	.41	3.73
Drafter	130	.07	3.55
Electrical/electronic technicians	110	.06	(1)
Mechanical engineering technician	100	.05	(1)
Industrial engineering technicians	100	.05	(1)
All other engineering technicians	170	.10	(1)
Biological technicians	120	.07	16.15
Chemical technicians	2,930	1.72	4.72
Petroleum technicians	200	.11	(1)

Paints and allied products (SIC 2850)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	9,140	13.39	(1)
Scientists	3,910	5.75	(1)
Computer analysts	200	.29	3.00
All other computer scientists	30	.04	(1)
Mathematical scientists	20	.02	(1)
Chemists	3,520	5.20	1.96
All other physical scientists	140	.20	(1)
All other life scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	430	.63	4.22
Engineers	1,040	1.49	(1)
Chemical	480	.71	4.43
Civil	20	.02	(1)
Electrical/electronic	10	.01	14.00
Computer	40	.05	10.58
Industrial	170	.25	2.00
Mechanical	90	.13	5.58
Safety	40	.05	(1)
Sales	130	.19	10.43
Other, n.e.c.	60	.08	(1)
Technicians	3,760	5.52	(1)
Computer programmer	160	.23	2.60
Drafter	10	.01	(1)
Electrical/electronic technicians	20	.02	(1)
Mechanical engineering technician	20	.02	(1)
All other engineering technicians	30	.04	(1)
Biological technicians	110	.16	9.32
Chemical technicians	3,340	4.94	1.88
Petroleum technicians	70	.10	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Industrial organic chemicals (SIC 2860)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	38,120	23.03	(1)
Scientists	9,530	5.75	(1)
Computer analysts	1,480	.89	1.69
All other computer scientists	120	.07	(1)
Mathematical scientists	20	.01	(1)
Chemists	6,480	3.93	.96
All other physical scientists	530	.32	(1)
Biological scientists	490	.29	.29
Medical scientists	220	.13	(1)
All other life scientists	190	.11	(1)
Managers of scientific and technical personnel	1,830	1.11	1.74
Engineers	11,480	6.92	(1)
Chemical	5,340	3.24	1.31
Civil	270	.16	.59
Electrical/electronic	750	.45	1.42
Computer	150	.09	4.50
Industrial	870	.52	(1)
Mechanical	1,590	.96	.50
Metallurgists/metallurgical	180	.10	.76
Safety	370	.22	2.35
Sales	200	.12	12.63
Other, n.e.c	1,760	1.06	(1)
Technicians	15,280	9.25	(1)
Computer programmer	770	.46	1.32
Drafter	600	.36	.71
Electrical/electronic technicians	990	.60	.17
Mechanical engineering technician	350	.21	(1)
Industrial engineering technicians	200	.12	(1)
All other engineering technicians	1,420	.86	(1)
Biological technicians	320	.19	(1)
Chemical technicians	9,790	5.94	1.13
Petroleum technicians	840	.51	(1)

Agricultural chemicals (SIC 2870)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	5,470	9.87	(1)
Scientists	1,600	2.88	(1)
Computer analysts	180	.32	0.90
All other computer scientists	20	.03	(1)
Mathematical scientists	(2)	(2)	(1)
Chemists	1,000	1.82	2.98
All other physical scientists	130	.23	(1)
Biological scientists	260	.47	5.40
All other life scientists	10	.01	(1)
Managers of scientific and technical personnel	370	.67	1.79
Engineers	1,450	2.62	(1)
Chemical	690	1.26	.67
Civil	60	.10	(1)
Electrical/electronic	100	.18	4.21
Computer	30	.05	(1)
Industrial	90	.16	(1)
Mechanical	230	.42	1.80
Safety	100	.18	8.54
Sales	50	.09	46.50
Other, n.e.c	100	.18	(1)
Technicians	2,050	3.70	(1)
Computer programmer	210	.38	.78
Drafter	100	.18	1.55
Electrical/electronic technicians	120	.21	(1)
Mechanical engineering technician	30	.05	(1)
All other engineering technicians	120	.21	(1)
Biological technicians	70	.12	15.46
Chemical technicians	1,310	2.39	2.72
Petroleum technicians	90	.16	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Misc. chemical products (SIC 2890)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	13,990	13.18	(1)
Scientists	3,800	3.57	(1)
Computer analysts	340	.32	2.15
All other computer scientists	10	(2)	(1)
Mathematical scientists	10	(2)	13.33
Chemists	3,290	3.13	3.63
All other physical scientists	70	.06	(1)
Biological scientists	60	.05	17.67
All other life scientists	20	.01	(1)
Managers of scientific and technical personnel	1,010	.96	3.35
Engineers	4,210	3.97	(1)
Chemical	1,050	1.00	2.83
Civil	110	.10	2.26
Electrical/electronic	190	.18	12.30
Computer	80	.07	(1)
Industrial	250	.23	3.39
Mechanical	740	.70	5.73
Metallurgists/metallurgical	60	.05	(1)
Safety	200	.19	3.11
Sales	1,320	1.25	6.36
Other, n.e.c	210	.20	(1)
Technicians	4,970	4.68	(1)
Computer programmer	250	.23	1.67
Drafter	260	.24	2.65
Electrical/electronic technicians	110	.10	16.81
Mechanical engineering technician	60	.05	(1)
Industrial engineering technicians	40	.03	(1)
All other engineering technicians	400	.38	(1)
Biological technicians	80	.07	42.37
Chemical technicians	3,520	3.35	3.48
Petroleum technicians	250	.23	(1)

Petroleum refining (SIC 2910)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	20,360	16.40	(1)
Scientists	3,710	2.98	(1)
Computer analysts	1,060	.86	0.28
All other computer scientists	110	.08	(1)
Chemists	1,740	1.41	1.43
Geologists, geophysicists, and earth scientists	380	.30	(1)
All other physical scientists	390	.31	(1)
Life scientists, unspecified	30	.02	(1)
Managers of scientific and technical personnel	1,080	.87	.85
Engineers	8,280	6.68	(1)
Chemical	3,170	2.57	.22
Civil	510	.41	.78
Electrical/electronic	700	.56	.32
Computer	450	.36	1.27
Industrial	420	.34	.57
Mechanical	1,240	1.00	.21
Petroleum	530	.43	(1)
Safety	360	.29	1.28
Sales	80	.06	7.64
Other, n.e.c	820	.66	(1)
Technicians	7,290	5.87	(1)
Computer programmer	390	.31	8.24
Drafter	640	.51	.37
Electrical/electronic technicians	600	.48	(1)
Mechanical engineering technician	350	.28	.28
Industrial engineering technicians	260	.21	(1)
All other engineering technicians	890	.72	(1)
Chemical technicians	3,550	2.88	.97
Petroleum technicians	270	.21	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Asphalt paving and roofing materials (SIC 2950)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	780	2.69	(1)
Scientists	100	.34	(1)
Computer analysts	10	.03	(1)
All other computer scientists	(2)	(2)	(1)
Chemists	90	.31	10.25
Managers of scientific and technical personnel	120	.42	12.63
Engineers	250	.86	(1)
Civil	30	.10	21.64
Electrical/electronic	10	.03	40.00
Industrial	30	.10	15.71
Mechanical	60	.21	13.73
Safety	(2)	(2)	(1)
Sales	20	.07	(1)
Other, n.e.c	100	.35	(1)
Technicians	310	1.07	(1)
Computer programmer	40	.14	28.97
Drafter	20	.07	36.86
Electrical/electronic technicians	10	.03	40.00
Mechanical engineering technician	10	.03	40.00
All other engineering technicians	40	.14	(1)
Chemical technicians	160	.56	15.05
Petroleum technicians	(2)	(2)	(1)

Misc. petroleum and coal products (SIC 2990)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,130	9.24	(1)
Scientists	380	3.12	(1)
Computer analysts	20	.16	9.00
All other computer scientists	(2)	(2)	(1)
Chemists	330	2.72	3.29
All other physical scientists	10	.08	(1)
Life scientists, unspecified	20	.16	(1)
Managers of scientific and technical personnel	110	.90	4.28
Engineers	190	1.54	(1)
Chemical	50	.41	11.68
Computer	10	.08	12.00
Industrial	20	.16	12.22
Safety	10	.08	27.69
Sales	60	.49	3.64
Other, n.e.c	40	.32	(1)
Technicians	450	3.68	(1)
Computer programmer	30	.24	4.15
All other engineering technicians	50	.41	(1)
Chemical technicians	320	2.63	1.98
Petroleum technicians	20	.16	(1)

Tires and inner tubes (SIC 3010)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,580	4.06	(1)
Scientists	380	.43	(1)
Computer analysts	200	.23	(1)
All other computer scientists	10	.01	(1)
Chemists	140	.16	(1)
All other physical scientists	30	.03	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	360	.41	(1)
Engineers	1,540	1.76	(1)
Chemical	280	.32	(1)
Electrical/electronic	150	.17	(1)
Computer	30	.03	(1)
Industrial	440	.51	(1)
Mechanical	420	.48	(1)
Sales	30	.03	(1)
Other, n.e.c	190	.22	(1)
Technicians	1,300	1.46	(1)
Computer programmer	120	.13	(1)
Drafter	100	.11	(1)
Electrical/electronic technicians	130	.15	(1)
Mechanical engineering technician	170	.19	(1)
Industrial engineering technicians	30	.03	(1)
All other engineering technicians	350	.40	(1)
Chemical technicians	240	.27	(1)
Petroleum technicians	160	.18	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Rubber and plastics footwear (SIC 3020)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	220	2.00	(1)
Scientists	60	.55	(1)
Computer analysts	50	.46	(1)
All other computer scientists	10	.09	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	40	.37	(1)
Engineers	60	.54	(1)
Chemical	10	.09	(1)
Computer	(2)	(2)	(1)
Industrial	20	.18	(1)
Mechanical	20	.18	(1)
Other, n.e.c	10	.09	(1)
Technicians	60	.54	(1)
Computer programmer	20	.18	(1)
Drafter	10	.09	(1)
Industrial engineering technicians	10	.09	(1)
All other engineering technicians	(2)	(2)	(1)
Chemical technicians	20	.18	(1)

Hose & belting & gaskets & packing (SIC 3050)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	3,340	5.30	(1)
Scientists	280	.43	(1)
Computer analysts	190	.30	(1)
All other computer scientists	10	.01	(1)
Chemists	80	.12	(1)
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	460	.74	2.16
Engineers	1,510	2.40	(1)
Chemical	160	.25	3.26
Electrical/electronic	80	.12	(1)
Computer	70	.11	(1)
Industrial	300	.48	(1)
Mechanical	520	.84	2.58
Sales	160	.25	1.10
Other, n.e.c	220	.35	(1)
Technicians	1,090	1.73	(1)
Computer programmer	60	.09	5.20
Drafter	180	.29	2.52
Mechanical engineering technician	140	.22	(1)
Industrial engineering technicians	60	.09	(1)
All other engineering technicians	380	.61	(1)
Chemical technicians	250	.40	(1)
Petroleum technicians	20	.03	(1)

Fabricated rubber products, nec (SIC 3060)

Scientists, engineers, and technicians	Total	Percent of total industry employ- ment	Relative error
Scientific and technical personnel	5,200	4.52	(1)
Scientists	570	.48	(1)
Computer analysts	200	.17	1.80
All other computer scientists	(2)	(2)	(1)
Chemists	320	.28	4.68
All other physical scientists	10	(2)	(1)
Life scientists, unspecified	40	.03	(1)
Managers of scientific and technical personnel	530	.47	3.21
Engineers	2,110	1.84	(1)
Chemical	310	.27	2.76
Electrical/electronic	100	.08	1.41
Computer	60	.05	5.48
Industrial	430	.38	2.84
Mechanical	870	.77	1.94
Sales	200	.17	4.18
Other, n.e.c	140	.12	(1)
Technicians	1,990	1.73	(1)
Computer programmer	170	.15	3.06
Drafter	320	.28	4.06
Electrical/electronic technicians	100	.08	1.35
Mechanical engineering technician	290	.25	2.42
Industrial engineering technicians	110	.09	3.54
All other engineering technicians	220	.19	(1)
Chemical technicians	720	.64	4.19
Petroleum technicians	60	.05	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Misc. plastics products, nec (SIC 3080)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	21,130	3.24	(1)
Scientists	1,270	.16	(1)
Computer analysts	630	.09	3.43
All other computer scientists	50	(2)	(1)
Chemists	500	.07	9.12
All other physical scientists	50	(2)	(1)
Life scientists, unspecified	40	(2)	50.36
Managers of scientific and technical personnel	2,940	.46	4.49
Engineers	9,590	1.49	(1)
Chemical	1,180	.18	7.07
Electrical/electronic	570	.09	7.45
Computer	270	.04	8.68
Industrial	1,440	.22	3.77
Mechanical	3,920	.62	3.75
Sales	860	.13	9.93
Other, n.e.c	1,350	.21	(1)
Technicians	7,330	1.13	(1)
Computer programmer	630	.09	5.20
Drafter	2,040	.32	7.78
Electrical/electronic technicians	620	.09	3.98
Mechanical engineering technician	840	.13	4.20
Industrial engineering technicians	380	.06	6.59
All other engineering technicians	820	.13	(1)
Chemical technicians	1,770	.28	9.69
Petroleum technicians	230	.03	(1)

Leather tanning and finishing (SIC 3110)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	240	1.56	(1)
Scientists	60	.38	(1)
Computer analysts	10	.06	(1)
Chemists	30	.20	6.45
All other physical scientists	10	.06	(1)
Life scientists, unspecified	10	.06	(1)
Managers of scientific and technical personnel	30	.20	(1)
Engineers	40	.26	(1)
Industrial	20	.13	5.33
Mechanical	20	.13	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	110	.72	(1)
Computer programmer	20	.13	(1)
Industrial engineering technicians	(2)	(2)	(1)
All other engineering technicians	20	.13	(1)
Chemical technicians	60	.40	(1)
Petroleum technicians	10	.06	(1)

Footwear cut stock (SIC 3130)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	10	0.15	(1)
Scientists	(2)	(2)	(1)
All other physical scientists	(2)	(2)	(1)
Engineers	10	.15	(1)
Mechanical	10	.15	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)
Petroleum technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Footwear, except rubber (SIC 3140)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	960	1.10	(1)
Scientists	300	.37	(1)
Computer analysts	180	.22	2.47
All other computer scientists	120	.15	(1)
Chemists	(2)	(2)	(1)
Managers of scientific and technical personnel	150	.19	1.39
Engineers	180	.22	(1)
Industrial	120	.15	7.26
Mechanical	40	.05	(1)
Other, n.e.c	20	.02	(1)
Technicians	330	.40	(1)
Computer programmer	220	.28	1.10
Mechanical engineering technician	10	.01	(1)
Industrial engineering technicians	60	.07	8.09
All other engineering technicians	30	.03	(1)
Petroleum technicians	10	.01	(1)

Leather gloves and mittens (SIC 3150)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	(2)	(2)	(1)
Scientists	(2)	(2)	(1)
All other computer scientists	(2)	(2)	(1)

Luggage (SIC 3160)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	160	1.37	(1)
Scientists	20	.17	(1)
All other computer scientists	20	.17	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	20	.17	(1)
Engineers	80	.70	(1)
Industrial	30	.26	4.31
Other, n.e.c	50	.44	(1)
Technicians	40	.33	(1)
Computer programmer	20	.17	(1)
All other engineering technicians	10	.08	(1)
Petroleum technicians	10	.08	(1)

Handbags and personal leather goods (SIC 3170)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	60	0.36	(1)
Scientists	10	.06	(1)
All other computer scientists	10	.06	(1)
Engineers	30	.18	(1)
Industrial	20	.12	(1)
Mechanical	10	.06	(1)
Technicians	20	.12	(1)
Computer programmer	20	.12	(1)
Industrial engineering technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Leather goods, nec (SIC 3190)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	40	0.44	(1)
Scientists	20	.22	(1)
Computer analysts	10	.11	(1)
All other computer scientists	10	.11	(1)
Managers of scientific and technical personnel	10	.11	(1)
Engineers	10	.11	(1)
Industrial	10	.11	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	(2)	(2)	(1)
All other engineering technicians	(2)	(2)	(1)
Petroleum technicians	(2)	(2)	(1)

Flat glass (SIC 3210)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	930	5.31	(1)
Scientists	80	.44	(1)
Computer analysts	60	.34	(1)
All other computer scientists	10	.05	(1)
Chemists	10	.05	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	40	.23	(1)
Engineers	500	2.88	(1)
Chemical	20	.11	(1)
Electrical/electronic	50	.29	(1)
Computer	10	.05	(1)
Industrial	220	1.28	(1)
Mechanical	90	.52	(1)
Metallurgists/metallurgical	40	.23	(1)
Other, n.e.c	70	.40	(1)
Technicians	310	1.76	(1)
Computer programmer	40	.23	(1)
Drafter	10	.05	(1)
Electrical/electronic technicians	60	.34	(1)
Tool programmer, numerical controls	100	.58	(1)
Industrial engineering technicians	20	.11	(1)
All other engineering technicians	70	.40	(1)
Chemical technicians	10	.05	(1)
Petroleum technicians	(2)	(2)	(1)

Glass and glassware, pressed or blown (SIC 3220)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,420	3.83	(1)
Scientists	240	.27	(1)
Computer analysts	150	.17	2.13
All other computer scientists	(2)	(2)	(1)
Chemists	70	.08	(1)
All other physical scientists	20	.02	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	390	.44	2.10
Engineers	1,440	1.61	(1)
Chemical	180	.20	1.83
Civil	20	.02	(1)
Electrical/electronic	190	.21	3.88
Computer	110	.12	6.63
Industrial	170	.19	5.57
Mechanical	430	.49	8.77
Metallurgists/metallurgical	140	.16	.84
Sales	30	.03	(1)
Other, n.e.c	170	.19	(1)
Technicians	1,350	1.51	(1)
Computer programmer	90	.10	6.32
Drafter	150	.17	2.91
Electrical/electronic technicians	170	.19	1.86
Mechanical engineering technician	190	.21	11.47
Tool programmer, numerical controls	50	.05	16.19
Industrial engineering technicians	240	.27	.51
Civil engineering technician	10	.01	(1)
All other engineering technicians	230	.26	(1)
Chemical technicians	220	.25	9.78

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Products of purchased glass (SIC 3230)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,250	2.05	(1)
Scientists	110	.18	(1)
Computer analysts	60	.10	(1)
All other computer scientists	(2)	(2)	(1)
Chemists	50	.08	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	110	.18	2.99
Engineers	580	.95	(1)
Chemical	10	.01	9.14
Electrical/electronic	70	.11	(1)
Computer	10	.01	(1)
Industrial	180	.30	(1)
Mechanical	200	.34	1.03
Sales	20	.03	(1)
Other, n.e.c	90	.15	(1)
Technicians	450	.74	(1)
Computer programmer	90	.15	(1)
Drafter	160	.27	(1)
Electrical/electronic technicians	50	.08	7.69
Mechanical engineering technician	60	.10	(1)
Industrial engineering technicians	20	.03	4.80
All other engineering technicians	50	.08	(1)
Chemical technicians	20	.03	(1)

Cement, hydraulic (SIC 3240)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,080	5.63	(1)
Scientists	210	1.10	(1)
Computer analysts	20	.10	(1)
All other computer scientists	10	.05	(1)
Chemists	180	.95	1.35
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	60	.31	14.60
Engineers	280	1.44	(1)
Chemical	40	.21	8.11
Civil	40	.21	7.30
Electrical/electronic	50	.26	7.83
Computer	10	.05	36.50
Industrial	30	.15	7.42
Mechanical	50	.26	7.55
Metallurgists/metallurgical	10	.05	(1)
Sales	20	.10	13.27
Other, n.e.c	30	.15	(1)
Technicians	530	2.78	(1)
Computer programmer	20	.10	(1)
Drafter	30	.15	(1)
Electrical/electronic technicians	70	.37	5.80
Tool programmer, numerical controls	(2)	(2)	(1)
All other engineering technicians	20	.10	(1)
Chemical technicians	360	1.91	7.41
Petroleum technicians	30	.15	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Structural clay products (SIC 3250)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,080	2.70	(1)
Scientists	50	.12	(1)
Computer analysts	20	.05	(1)
All other computer scientists	(2)	(2)	(1)
Chemists	20	.05	(1)
All other physical scientists	10	.02	(1)
Managers of scientific and technical personnel	90	.23	3.55
Engineers	570	1.43	(1)
Chemical	20	.05	18.63
Civil	20	.05	35.29
Electrical/electronic	10	.02	(1)
Computer	10	.02	(1)
Industrial	40	.10	16.41
Mechanical	60	.15	5.61
Metallurgists/metallurgical	150	.38	3.75
Sales	180	.46	2.32
Other, n.e.c	80	.20	(1)
Technicians	370	.92	(1)
Computer programmer	40	.10	(1)
Drafter	60	.15	4.92
Electrical/electronic technicians	(2)	(2)	(1)
Mechanical engineering technician	40	.10	12.39
Industrial engineering technicians	10	.02	(1)
All other engineering technicians	100	.25	(1)
Chemical technicians	110	.28	4.27
Petroleum technicians	10	.02	(1)

Pottery and related products (SIC 3260)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,480	3.54	(1)
Scientists	60	.13	(1)
Computer analysts	40	.09	(1)
All other computer scientists	10	.02	(1)
Chemists	10	.02	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	120	.29	(1)
Engineers	610	1.45	(1)
Chemical	20	.04	(1)
Civil	10	.02	(1)
Electrical/electronic	60	.14	(1)
Computer	10	.02	(1)
Industrial	100	.24	(1)
Mechanical	80	.19	2.67
Metallurgists/metallurgical	200	.49	(1)
Sales	90	.22	(1)
Other, n.e.c	40	.09	(1)
Technicians	690	1.67	(1)
Computer programmer	30	.07	(1)
Drafter	70	.17	(1)
Electrical/electronic technicians	50	.12	(1)
Mechanical engineering technician	80	.19	(1)
Industrial engineering technicians	90	.22	(1)
All other engineering technicians	240	.59	(1)
Chemical technicians	110	.27	.75
Petroleum technicians	20	.04	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Concrete, gypsum, and plaster products (SIC 3270)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,130	1.35	(1)
Scientists	120	.04	(1)
Computer analysts	40	.01	8.95
All other computer scientists	10	(2)	(1)
Chemists	70	.03	21.96
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	290	.13	4.45
Engineers	1,070	.45	(1)
Chemical	30	.01	21.07
Civil	420	.19	5.97
Electrical/electronic	50	.02	14.35
Computer	20	(2)	(1)
Industrial	90	.04	5.27
Mechanical	160	.07	8.77
Sales	170	.07	8.24
Other, n.e.c	130	.05	(1)
Technicians	1,650	.73	(1)
Computer programmer	90	.04	8.28
Drafter	1,230	.56	3.39
Electrical/electronic technicians	30	.01	(1)
Mechanical engineering technician	10	(2)	(1)
Industrial engineering technicians	10	(2)	(1)
Civil engineering technician	50	.02	7.78
All other engineering technicians	90	.04	(1)
Chemical technicians	140	.06	4.32
Petroleum technicians	(2)	(2)	(1)

Cut stone and stone products (SIC 3280)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	360	2.41	(1)
Scientists	10	.06	(1)
All other computer scientists	(2)	(2)	(1)
All other physical scientists	10	.06	(1)
Managers of scientific and technical personnel	10	.06	(1)
Engineers	50	.32	(1)
Industrial	20	.13	39.44
Mechanical	20	.13	15.05
Other, n.e.c	10	.06	(1)
Technicians	290	1.97	(1)
Computer programmer	10	.06	(1)
Drafter	270	1.85	7.35
All other engineering technicians	10	.06	(1)
Petroleum technicians	(2)	(2)	(1)

Misc. nonmetallic mineral products (SIC 3290)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	5,010	5.83	(1)
Scientists	560	.65	(1)
Computer analysts	340	.40	8.75
All other computer scientists	20	.02	(1)
Chemists	190	.22	.80
All other physical scientists	10	.01	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	450	.53	.61
Engineers	2,310	2.69	(1)
Chemical	230	.27	.77
Civil	50	.05	(1)
Electrical/electronic	330	.39	.49
Computer	40	.04	6.89
Industrial	470	.55	1.98
Mechanical	530	.62	2.77
Metallurgists/metallurgical	260	.30	2.41
Sales	180	.21	4.15
Other, n.e.c	220	.26	(1)
Technicians	1,690	1.96	(1)
Computer programmer	240	.28	1.01
Drafter	210	.24	2.66
Electrical/electronic technicians	80	.09	.94
Mechanical engineering technician	150	.17	.68
All other engineering technicians	510	.60	(1)
Chemical technicians	470	.55	.58
Petroleum technicians	30	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Blast furnace and basic steel products (SIC 3310)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	13,990	4.85	(1)
Scientists	1,790	.61	(1)
Computer analysts	1,110	.39	0.24
All other computer scientists	130	.04	(1)
Chemists	470	.16	.83
All other physical scientists	80	.02	(1)
Managers of scientific and technical personnel	1,400	.49	1.32
Engineers	6,280	2.18	(1)
Electrical/electronic	630	.22	2.36
Computer	610	.21	.60
Industrial	1,120	.39	.46
Mechanical	1,100	.38	1.21
Metallurgists/metallurgical	1,560	.55	1.86
Safety	300	.10	1.14
Sales	110	.03	11.01
Other, n.e.c	850	.30	(1)
Technicians	4,520	1.57	(1)
Computer programmer	540	.19	1.17
Drafter	690	.24	4.31
Electrical/electronic technicians	350	.12	.63
Mechanical engineering technician	250	.08	3.08
Industrial engineering technicians	200	.07	1.34
All other engineering technicians	1,530	.54	(1)
Chemical technicians	820	.29	1.81
Petroleum technicians	140	.04	(1)

Iron and steel foundries (SIC 3320)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	5,130	3.57	(1)
Scientists	280	.19	(1)
Computer analysts	210	.15	5.08
All other computer scientists	20	.01	(1)
Chemists	50	.03	(1)
All other physical scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	390	.27	8.54
Engineers	2,690	1.88	(1)
Electrical/electronic	120	.08	31.67
Computer	80	.05	5.74
Industrial	640	.45	11.17
Mechanical	650	.46	5.21
Metallurgists/metallurgical	510	.36	3.59
Safety	80	.05	5.25
Sales	160	.11	8.40
Other, n.e.c	450	.32	(1)
Technicians	1,770	1.23	(1)
Computer programmer	170	.12	2.59
Drafter	330	.23	6.37
Electrical/electronic technicians	140	.10	1.84
Mechanical engineering technician	180	.12	4.24
Industrial engineering technicians	190	.13	2.92
All other engineering technicians	580	.41	(1)
Chemical technicians	150	.10	8.48
Petroleum technicians	30	.02	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Primary nonferrous metals (SIC 3330)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	3,010	6.53	(1)
Scientists	440	.95	(1)
Computer analysts	130	.28	(1)
All other computer scientists	10	.02	(1)
Chemists	260	.57	(1)
All other physical scientists	40	.09	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	180	.39	1.33
Engineers	1,140	2.48	(1)
Electrical/electronic	190	.41	(1)
Computer	50	.11	(1)
Industrial	140	.30	(1)
Mechanical	260	.57	(1)
Metallurgists/metallurgical	260	.57	1.04
Safety	70	.15	(1)
Other, n.e.c	170	.37	(1)
Technicians	1,250	2.71	(1)
Computer programmer	60	.13	(1)
Drafter	140	.30	1.90
Electrical/electronic technicians	110	.24	(1)
Mechanical engineering technician	70	.15	(1)
Industrial engineering technicians	20	.04	(1)
All other engineering technicians	340	.74	(1)
Chemical technicians	430	.94	.32
Petroleum technicians	80	.17	(1)

Secondary nonferrous metals (SIC 3340)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	680	3.60	(1)
Scientists	110	.58	(1)
Computer analysts	30	.16	(1)
All other computer scientists	10	.05	(1)
Chemists	60	.32	6.86
All other physical scientists	10	.05	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	100	.53	10.06
Engineers	190	1.01	(1)
Computer	(2)	(2)	(1)
Industrial	30	.16	(1)
Mechanical	30	.16	(1)
Metallurgists/metallurgical	80	.43	10.38
Safety	10	.05	(1)
Sales	30	.16	(1)
Other, n.e.c	10	.05	(1)
Technicians	280	1.48	(1)
Computer programmer	30	.16	(1)
Drafter	50	.26	24.72
Electrical/electronic technicians	20	.10	(1)
All other engineering technicians	60	.32	(1)
Chemical technicians	120	.64	7.88
Petroleum technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Nonferrous rolling and drawing (SIC 3350)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	12,790	6.99	(1)
Scientists	1,460	.78	(1)
Computer analysts	910	.50	1.07
All other computer scientists	50	.02	(1)
Chemists	430	.23	4.01
All other physical scientists	70	.03	(1)
Managers of scientific and technical personnel	1,160	.64	4.23
Engineers	5,730	3.14	(1)
Electrical/electronic	700	.38	2.25
Computer	330	.18	.85
Industrial	790	.43	.65
Mechanical	970	.53	2.97
Metallurgists/metallurgical	860	.47	2.07
Safety	180	.10	3.02
Sales	390	.21	1.83
Other, n.e.c	1,510	.84	(1)
Technicians	4,440	2.43	(1)
Computer programmer	390	.21	.86
Drafter	860	.47	1.90
Electrical/electronic technicians	480	.26	2.43
Mechanical engineering technician	260	.14	10.12
Industrial engineering technicians	150	.08	(1)
All other engineering technicians	1,310	.72	(1)
Chemical technicians	900	.50	3.98
Petroleum technicians	90	.05	(1)

Nonferrous foundries (castings) (SIC 3360)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,730	2.98	(1)
Scientists	130	.13	(1)
Computer analysts	70	.07	3.96
All other computer scientists	10	.01	(1)
Chemists	50	.05	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	310	.34	1.52
Engineers	1,430	1.58	(1)
Electrical/electronic	30	.03	(1)
Industrial	260	.29	1.60
Mechanical	560	.63	.76
Metallurgists/metallurgical	200	.22	2.39
Safety	30	.03	[illegible]
Sales	130	.14	10.23
Other, n.e.c	220	.24	(1)
Technicians	860	.93	(1)
Computer programmer	60	.06	4.64
Drafter	210	.23	1.52
Electrical/electronic technicians	70	.07	(1)
Mechanical engineering technician	100	.11	10.61
Industrial engineering technicians	100	.11	2.58
All other engineering technicians	260	.29	(1)
Chemical technicians	60	.06	3.78
Petroleum technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Misc. primary metal products (SIC 3390)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,540	5.25	(1)
Scientists	120	.40	(1)
Computer analysts	20	.06	(1)
Chemists	100	.34	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	140	.48	5.08
Engineers	780	2.66	(1)
Electrical/electronic	30	.10	24.90
Computer	10	.03	(1)
Industrial	80	.27	(1)
Mechanical	170	.59	4.40
Metallurgists/metallurgical	330	1.15	3.81
Safety	20	.06	(1)
Sales	110	.38	(1)
Other, n.e.c	30	.10	(1)
Technicians	500	1.69	(1)
Computer programmer	20	.06	(1)
Drafter	70	.24	4.12
Electrical/electronic technicians	60	.20	44.69
Mechanical engineering technician	20	.06	(1)
Industrial engineering technicians	10	.03	(1)
All other engineering technicians	120	.41	(1)
Chemical technicians	200	.69	(1)
Petroleum technicians	(2)	(2)	(1)

Metal cans and shipping containers (SIC 3410)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,450	2.57	(1)
Scientists	240	.43	(1)
Computer analysts	130	.23	1.71
All other computer scientists	110	.20	(1)
Managers of scientific and technical personnel	160	.29	3.16
Engineers	580	1.02	(1)
Electrical/electronic	60	.10	5.71
Industrial	50	.09	3.53
Mechanical	360	.65	1.46
Metallurgists/metallurgical	40	.07	6.42
Safety	20	.03	9.97
Sales	20	.03	8.00
Other, n.e.c	30	.05	(1)
Technicians	470	.83	(1)
Computer programmer	40	.07	5.98
Drafter	110	.20	9.59
Electrical/electronic technicians	90	.16	11.17
Mechanical engineering technician	40	.07	27.63
Tool programmer, numerical controls	(2)	(2)	(1)
Industrial engineering technicians	40	.07	12.56
All other engineering technicians	130	.23	(1)
Physical and life science technicians, unspec	20	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Cutlery, handtools, and hardware (SIC 3420)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	5,600	4.01	(1)
Scientists	380	.27	(1)
Computer analysts	340	.25	1.29
All other computer scientists	20	.01	(1)
Life scientists, unspecified	20	.01	(1)
Managers of scientific and technical personnel	730	.53	3.30
Engineers	2,820	2.03	(1)
Civil	30	.02	(1)
Electrical/electronic	160	.11	13.03
Computer	70	.05	6.67
Industrial	580	.42	1.90
Mechanical	1,260	.92	5.79
Metallurgists/metallurgical	80	.05	3.88
Safety	40	.02	(1)
Sales	300	.22	48.28
Other, n.e.c	300	.22	(1)
Technicians	1,670	1.18	(1)
Computer programmer	240	.17	2.68
Drafter	690	.50	8.00
Electrical/electronic technicians	80	.05	2.05
Mechanical engineering technician	200	.14	2.71
Tool programmer, numerical controls	70	.05	5.95
Industrial engineering technicians	150	.11	4.36
All other engineering technicians	200	.14	(1)
Physical and life science technicians, unspec	40	.02	(1)

Plumbing and heating, except electric (SIC 3430)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	2,990	4.72	(1)
Scientists	160	.25	(1)
Computer analysts	160	.25	0.96
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	410	.65	1.39
Engineers	1,220	1.92	(1)
Electrical/electronic	90	.14	7.67
Computer	40	.06	(1)
Industrial	220	.35	2.88
Mechanical	510	.81	4.34
Metallurgists/metallurgical	10	.01	(1)
Safety	30	.04	(1)
Sales	150	.24	7.87
Other, n.e.c	170	.27	(1)
Technicians	1,200	1.90	(1)
Computer programmer	120	.19	5.03
Drafter	600	.96	2.31
Electrical/electronic technicians	90	.14	(1)
Mechanical engineering technician	130	.20	3.48
Tool programmer, numerical controls	40	.06	5.24
Industrial engineering technicians	120	.19	.83
All other engineering technicians	100	.16	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Fabricated structural metal products (SIC 3440)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	25,130	5.65	(1)
Scientists	740	.16	(1)
Computer analysts	700	.16	3.24
All other computer scientists	40	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	1,940	.44	2.97
Engineers	8,160	1.82	(1)
Civil	760	.17	10.23
Electrical/electronic	340	.07	7.23
Computer	190	.04	6.08
Industrial	1,090	.24	3.63
Mechanical	3,460	.79	3.42
Metallurgists/metallurgical	340	.07	15.21
Safety	100	.02	8.32
Sales	1,230	.28	8.80
Other, n.e.c	650	.14	(1)
Technicians	14,290	3.23	(1)
Computer programmer	740	.16	6.54
Drafter	11,020	2.52	2.92
Electrical/electronic technicians	380	.08	10.26
Mechanical engineering technician	510	.11	6.54
Tool programmer, numerical controls	320	.07	6.67
Industrial engineering technicians	320	.07	6.27
All other engineering technicians	920	.21	(1)
Physical and life science technicians, unspec	80	.01	(1)

Screw machine products, bolts, etc. (SIC 3450)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,960	3.75	(1)
Scientists	220	.20	(1)
Computer analysts	200	.19	2.08
All other computer scientists	20	.01	(1)
Managers of scientific and technical personnel	470	.46	5.16
Engineers	1,950	1.85	(1)
Civil	30	.02	(1)
Electrical/electronic	130	.12	5.87
Computer	50	.04	9.20
Industrial	220	.21	2.63
Mechanical	1,100	1.08	4.17
Metallurgists/metallurgical	100	.09	(1)
Safety	10	(2)	30.00
Sales	260	.25	2.25
Other, n.e.c	50	.04	(1)
Technicians	1,320	1.24	(1)
Computer programmer	170	.16	20.50
Drafter	450	.44	12.76
Electrical/electronic technicians	50	.04	(1)
Mechanical engineering technician	260	.25	2.00
Tool programmer, numerical controls	130	.12	4.33
Industrial engineering technicians	100	.09	4.02
All other engineering technicians	140	.13	(1)
Physical and life science technicians, unspec	20	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Metal forgings and stampings (SIC 3460)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	9,140	3.74	(1)
Scientists	420	.16	(1)
Computer analysts	350	.14	4.54
All other computer scientists	70	.02	(1)
Managers of scientific and technical personnel	900	.37	4.08
Engineers	4,970	2.04	(1)
Civil	60	.02	23.19
Electrical/electronic	110	.04	6.31
Computer	100	.04	7.32
Industrial	850	.35	5.37
Mechanical	1,890	.79	7.28
Metallurgists/metallurgical	230	.09	5.53
Safety	170	.07	6.22
Sales	380	.15	10.81
Other, n.e.c	1,180	.49	(1)
Technicians	2,850	1.17	(1)
Computer programmer	390	.16	2.81
Drafter	1,000	.42	6.28
Electrical/electronic technicians	220	.09	6.45
Mechanical engineering technician	430	.18	10.05
Tool programmer, numerical controls	220	.09	9.22
Industrial engineering technicians	160	.06	4.65
All other engineering technicians	390	.16	(1)
Physical and life science technicians, unspec	40	.01	(1)

Metal services, nec (SIC 3470)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,840	1.38	(1)
Scientists	70	.04	(1)
Computer analysts	50	.04	2.61
All other computer scientists	10	(2)	(1)
Life scientists, unspecified	10	(2)	(1)
Managers of scientific and technical personnel	190	.15	4.95
Engineers	790	.59	(1)
Civil	10	(2)	28.00
Electrical/electronic	40	.03	7.00
Computer	10	(2)	10.33
Industrial	100	.08	7.42
Mechanical	290	.23	13.25
Metallurgists/metallurgical	80	.06	3.60
Safety	30	.02	7.33
Sales	110	.08	10.45
Other, n.e.c	120	.09	(1)
Technicians	790	.60	(1)
Computer programmer	70	.05	3.14
Drafter	230	.18	8.75
Electrical/electronic technicians	30	.02	7.59
Mechanical engineering technician	20	.01	(1)
Tool programmer, numerical controls	20	.01	(1)
Industrial engineering technicians	30	.02	26.15
All other engineering technicians	180	.14	(1)
Physical and life science technicians, unspec	210	.17	8.96

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Ordnance and accessories, nec (SIC 3480)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	9,420	12.30	(1)
Scientists	380	.49	(1)
Computer analysts	350	.46	0.53
All other computer scientists	30	.03	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	830	1.09	.64
Engineers	5,500	7.19	(1)
Civil	120	.15	(1)
Electrical/electronic	450	.59	.73
Computer	260	.34	(1)
Industrial	1,250	1.64	2.94
Mechanical	1,200	1.57	1.52
Metallurgists/metallurgical	70	.09	(1)
Safety	190	.24	1.06
Sales	20	.02	27.71
Other, n.e.c.	1,940	2.55	(1)
Technicians	2,710	3.53	(1)
Computer programmer	140	.18	1.39
Drafter	470	.61	2.64
Electrical/electronic technicians	390	.51	(1)
Mechanical engineering technician	410	.53	.40
Tool programmer, numerical controls	50	.06	(1)
Industrial engineering technicians	320	.42	(1)
All other engineering technicians	800	1.05	(1)
Physical and life science technicians, unspec	130	.17	(1)

Misc. fabricated metal products (SIC 3490)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	11,650	4.76	(1)
Scientists	380	.15	(1)
Computer analysts	370	.15	3.50
All other computer scientists	10	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	1,250	.52	2.24
Engineers	5,590	2.29	(1)
Civil	50	.02	6.15
Electrical/electronic	410	.17	2.58
Computer	200	.08	7.10
Industrial	900	.37	2.34
Mechanical	2,600	1.08	2.71
Metallurgists/metallurgical	260	.10	10.29
Safety	70	.02	13.36
Sales	830	.34	1.94
Other, n.e.c.	270	.11	(1)
Technicians	4,430	1.80	(1)
Computer programmer	360	.14	2.19
Drafter	2,280	.94	2.35
Electrical/electronic technicians	370	.15	2.34
Mechanical engineering technician	540	.22	4.02
Tool programmer, numerical controls	200	.08	3.93
Industrial engineering technicians	200	.08	4.81
All other engineering technicians	400	.16	(1)
Physical and life science technicians, unspec	80	.03	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Engines and turbines (SIC 3510)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	16,340	17.30	(1)
Scientists	900	.95	(1)
Computer analysts	810	.86	(1)
All other computer scientists	60	.06	(1)
Operations and systems researchers and analysts	20	.02	(1)
Mathematical scientists	10	.01	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	1,300	1.38	0.18
Engineers	9,690	10.28	(1)
Chemical	110	.11	1.63
Civil	140	.14	(1)
Electrical/electronic	920	.98	.27
Computer	190	.20	.56
Industrial	1,090	1.16	(1)
Mechanical	5,790	6.17	.05
Metallurgists/metallurgical	300	.31	(1)
Sales	550	.58	.15
Other, n.e.c.	600	.63	(1)
Technicians	4,450	4.69	(1)
Computer programmer	320	.34	(1)
Drafter	1,640	1.74	1.85
Electrical/electronic technicians	520	.55	.15
Mechanical engineering technician	730	.77	.12
Tool programmer, numerical controls	170	.18	(1)
Industrial engineering technicians	260	.27	(1)
Civil engineering technician	70	.07	(1)
All other engineering technicians	580	.61	(1)
Chemical technicians	130	.13	(1)
Petroleum technicians	30	.03	(1)

Farm and garden machinery (SIC 3520)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	7,270	6.65	(1)
Scientists	960	.88	(1)
Computer analysts	600	.56	0.41
All other computer scientists	350	.32	(1)
Operations and systems researchers and analysts	10	(2)	(1)
Mathematical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	620	.57	3.31
Engineers	3,220	2.96	(1)
Agricultural	660	.61	.85
Chemical	50	.04	2.35
Civil	40	.03	3.16
Electrical/electronic	110	.10	8.42
Computer	90	.08	14.62
Industrial	570	.53	2.70
Mechanical	1,100	1.02	4.28
Metallurgists/metallurgical	120	.11	(1)
Sales	270	.25	10.70
Other, n.e.c.	210	.19	(1)
Technicians	2,470	2.24	(1)
Computer programmer	310	.28	4.08
Drafter	880	.82	5.76
Electrical/electronic technicians	180	.16	6.47
Mechanical engineering technician	390	.36	2.04
Tool programmer, numerical controls	110	.10	2.34
Industrial engineering technicians	200	.18	1.52
Civil engineering technician	10	(2)	(1)
All other engineering technicians	330	.30	(1)
Chemical technicians	50	.04	(1)
Petroleum technicians	10	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Construction and related machinery (SIC 3530)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	26,000	11.34	(1)
Scientists	1,800	.81	(1)
Computer analysts	1,600	.70	2.18
All other computer scientists	150	.06	(1)
Operations and systems researchers and analysts	130	.05	(1)
Managers of scientific and technical personnel	2,380	1.04	5.58
Engineers	12,800	5.60	(1)
Agricultural	20	(2)	(1)
Civil	160	.07	3.15
Electrical/electronic	1,500	.66	3.26
Computer	550	.24	6.78
Industrial	1,580	.69	4.27
Mechanical	5,940	2.61	1.94
Metallurgists/metallurgical	280	.12	7.69
Sales	1,540	.67	4.18
Other, n.e.c	1,230	.54	(1)
Technicians	8,940	3.89	(1)
Computer programmer	720	.31	5.35
Drafter	4,520	1.99	2.89
Electrical/electronic technicians	690	.30	2.32
Mechanical engineering technician	910	.40	5.48
Tool programmer, numerical controls	340	.14	4.30
Industrial engineering technicians	520	.22	2.37
All other engineering technicians	780	.34	(1)
Chemical technicians	330	.14	1.96
Petroleum technicians	130	.05	(1)

Metalworking machinery (SIC 3540)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	28,500	8.27	(1)
Scientists	780	.21	(1)
Computer analysts	580	.16	3.19
All other computer scientists	200	.05	(1)
Mathematical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	2,900	.84	3.92
Engineers	14,350	4.17	(1)
Chemical	40	.01	41.37
Civil	70	.02	9.67
Electrical/electronic	1,790	.52	6.73
Computer	700	.20	7.93
Industrial	1,310	.38	2.46
Mechanical	6,540	1.91	2.84
Metallurgists/metallurgical	310	.09	4.65
Sales	2,480	.72	6.50
Other, n.e.c	1,110	.32	(1)
Technicians	10,550	3.05	(1)
Computer programmer	1,380	.40	8.19
Drafter	5,140	1.50	3.55
Electrical/electronic technicians	1,110	.32	7.48
Mechanical engineering technician	690	.20	2.59
Tool programmer, numerical controls	1,200	.35	[illegible]
Industrial engineering technicians	240	.07	8.35
Civil engineering technician	20	(2)	24.44
All other engineering technicians	640	.18	(1)
Chemical technicians	110	.03	(1)
Petroleum technicians	20	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Special industry machinery (SIC 3550)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	22,050	13.18	(1)
Scientists	570	.32	(1)
Computer analysts	500	.30	1.02
All other computer scientists	20	.01	(1)
Operations and systems researchers and analysts	30	.01	9.58
Mathematical scientists	10	(2)	(1)
Life scientists, unspecified	10	(2)	14.92
Managers of scientific and technical personnel	2,030	1.22	2.19
Engineers	10,770	6.46	(1)
Agricultural	30	.01	(1)
Chemical	200	.12	3.49
Civil	10	(2)	(1)
Electrical/electronic	2,190	1.32	5.49
Computer	700	.42	4.56
Industrial	750	.45	3.10
Mechanical	4,620	2.78	2.58
Metallurgists/metallurgical	60	.03	4.98
Sales	1,680	1.01	5.49
Other, n.e.c	530	.32	(1)
Technicians	8,680	5.18	(1)
Computer programmer	690	.41	3.35
Drafter	3,960	2.39	2.54
Electrical/electronic technicians	1,480	.89	3.68
Mechanical engineering technician	860	.51	1.64
Tool programmer, numerical controls	360	.21	2.56
Industrial engineering technicians	190	.11	4.60
Civil engineering technician	10	(2)	(1)
All other engineering technicians	970	.58	(1)
Chemical technicians	130	.07	2.54
Petroleum technicians	30	.01	(1)

General industrial machinery (SIC 3560)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	26,350	10.54	(1)
Scientists	840	.32	(1)
Computer analysts	690	.27	2.14
All other computer scientists	60	.02	(1)
Operations and systems researchers and analysts	50	.02	(1)
Mathematical scientists	10	(2)	(1)
Life scientists, unspecified	30	.01	(1)
Managers of scientific and technical personnel	2,650	1.07	2.14
Engineers	13,220	5.30	(1)
Agricultural	(2)	(2)	(1)
Chemical	340	.13	4.97
Civil	80	.03	14.32
Electrical/electronic	1,510	.61	5.46
Computer	410	.16	14.26
Industrial	1,670	.67	2.38
Mechanical	5,140	2.07	2.70
Metallurgists/metallurgical	210	.08	4.42
Sales	2,600	1.05	4.74
Other, n.e.c	1,260	.50	(1)
Technicians	9,640	3.85	(1)
Computer programmer	870	.35	7.90
Drafter	4,360	1.76	2.02
Electrical/electronic technicians	1,200	.48	6.35
Mechanical engineering technician	900	.36	4.60
Tool programmer, numerical controls	430	.17	2.33
Industrial engineering technicians	370	.14	2.24
Civil engineering technician	50	.02	9.23
All other engineering technicians	1,180	.47	(1)
Chemical technicians	240	.09	10.44
Petroleum technicians	40	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Computer and office equipment (SIC 3570)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	176,310	37.38	(1)
Scientists	12,420	2.62	(1)
Computer analysts	10,640	2.26	2.08
All other computer scientists	440	.09	(1)
Operations and systems researchers and analysts	880	.18	2.57
Mathematical scientists	460	.09	1.12
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	17,360	3.69	1.07
Engineers	84,360	17.89	(1)
Chemical	180	.03	1.57
Civil	80	.01	(1)
Electrical/electronic	31,770	6.75	1.54
Computer	19,000	4.04	2.13
Industrial	4,880	1.03	1.10
Mechanical	4,450	.94	2.77
Metallurgists/metallurgical	90	.01	3.78
Sales	1,790	.38	5.38
Other, n.e.c	22,120	4.70	(1)
Technicians	62,170	13.18	(1)
Computer programmer	26,890	5.71	.37
Drafter	3,030	.64	6.16
Electrical/electronic technicians	25,170	5.35	1.53
Mechanical engineering technician	2,580	.54	1.26
Tool programmer, numerical controls	100	.02	10.48
Industrial engineering technicians	1,140	.24	.26
Civil engineering technician	10	(2)	(1)
All other engineering technicians	2,860	.60	(1)
Chemical technicians	200	.04	2.60
Petroleum technicians	190	.04	(1)

Refrigeration and service machinery (SIC 3580)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	12,310	6.19	(1)
Scientists	580	.28	(1)
Computer analysts	500	.25	1.47
All other computer scientists	40	.02	(1)
Operations and systems researchers and analysts	20	.01	(1)
Mathematical scientists	10	(2)	43.08
Life scientists, unspecified	10	(2)	23.33
Managers of scientific and technical personnel	1,390	.71	3.20
Engineers	5,460	2.75	(1)
Chemical	90	.04	9.01
Civil	30	.01	(1)
Electrical/electronic	640	.32	4.60
Computer	170	.08	6.90
Industrial	1,150	.58	1.49
Mechanical	1,920	.98	2.63
Metallurgists/metallurgical	50	.02	6.09
Sales	940	.48	4.27
Other, n.e.c	470	.24	(1)
Technicians	4,880	2.45	(1)
Computer programmer	390	.19	3.95
Drafter	2,180	1.11	3.25
Electrical/electronic technicians	680	.34	6.90
Mechanical engineering technician	720	.36	4.28
Tool programmer, numerical controls	80	.04	1.56
Industrial engineering technicians	280	.14	1.14
Civil engineering technician	20	.01	(1)
All other engineering technicians	380	.19	(1)
Chemical technicians	120	.06	20.55
Petroleum technicians	30	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Industrial machinery, nec (SIC 3590)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	18,970	5.67	(1)
Scientists	580	.16	(1)
Computer analysts	360	.10	0.88
All other computer scientists	40	.01	(1)
Operations and systems researchers and analysts	70	.02	(1)
Mathematical scientists	100	.03	(1)
Life scientists, unspecified	10	(2)	(1)
Managers of scientific and technical personnel	2,450	.74	8.20
Engineers	9,630	2.88	(1)
Chemical	20	(2)	22.05
Civil	60	.01	(1)
Electrical/electronic	1,440	.43	4.84
Computer	420	.12	22.90
Industrial	1,150	.35	4.34
Mechanical	4,000	1.22	5.82
Metallurgists/metallurgical	260	.07	15.57
Sales	1,200	.36	9.39
Other, n.e.c	1,080	.32	(1)
Technicians	6,310	1.89	(1)
Computer programmer	1,090	.33	2.69
Drafter	2,380	.72	5.56
Electrical/electronic technicians	960	.29	8.51
Mechanical engineering technician	690	.21	1.99
Tool programmer, numerical controls	510	.15	5.48
Industrial engineering technicians	220	.06	2.15
All other engineering technicians	400	.12	(1)
Chemical technicians	40	.01	(1)
Petroleum technicians	20	(2)	(1)

Electrical distribution equipment (SIC 3610)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	12,650	12.29	(1)
Scientists	830	.78	(1)
Computer analysts	750	.73	0.53
All other computer scientists	30	.02	(1)
Operations and systems researchers and analysts	40	.03	(1)
Mathematical scientists	(2)	(2)	(1)
All other physical scientists	10	(2)	(1)
Managers of scientific and technical personnel	1,060	1.04	2.92
Engineers	6,180	6.02	(1)
Chemical	20	.01	(1)
Civil	60	.05	(1)
Electrical/electronic	2,230	2.19	2.02
Computer	200	.19	4.93
Industrial	1,050	1.03	.86
Mechanical	1,710	1.68	1.28
Metallurgists/metallurgical	30	.02	10.35
Safety	60	.05	3.64
Sales	500	.49	6.18
Other, n.e.c	320	.31	(1)
Technicians	4,580	4.45	(1)
Computer programmer	510	.50	3.79
Drafter	1,740	1.71	3.78
Electrical/electronic technicians	1,610	1.58	2.98
Mechanical engineering technician	180	.17	1.02
Tool programmer, numerical controls	70	.06	2.16
Industrial engineering technicians	140	.13	.85
All other engineering technicians	280	.27	(1)
Chemical technicians	40	.03	(1)
Petroleum technicians	10	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Electrical industrial apparatus (SIC 3620)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	23,270	12.59	(1)
Scientists	800	.41	(1)
Computer analysts	460	.25	1.38
All other computer scientists	60	.03	(1)
Operations and systems researchers and analysts	50	.02	(1)
Mathematical scientists	30	.01	(1)
Chemists	50	.02	(1)
Physicists and astronomers	130	.07	1.83
All other physical scientists	20	.01	(1)
Managers of scientific and technical personnel	1,770	.96	2.57
Engineers	11,870	6.43	(1)
Chemical	310	.16	.78
Civil	50	.02	(1)
Electrical/electronic	5,360	2.93	1.54
Computer	600	.32	4.91
Industrial	1,310	.71	1.53
Mechanical	1,840	1.00	1.40
Metallurgists/metallurgical	260	.14	.93
Safety	100	.05	2.35
Sales	1,200	.65	2.13
Other, n.e.c	840	.45	(1)
Technicians	8,830	4.79	(1)
Computer programmer	650	.35	3.26
Drafter	2,200	1.20	2.18
Electrical/electronic technicians	3,730	2.02	2.49
Mechanical engineering technician	550	.30	1.42
Tool programmer, numerical controls	190	.10	4.89
Industrial engineering technicians	260	.14	2.34
Civil engineering technician	50	.02	28.96
All other engineering technicians	1,000	.54	(1)
Chemical technicians	100	.05	(1)
Petroleum technicians	100	.05	(1)

Household appliances (SIC 3630)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	5,460	4.07	(1)
Scientists	580	.42	(1)
Computer analysts	420	.32	(1)
All other computer scientists	110	.08	(1)
Operations and systems researchers and analysts	10	(2)	(1)
Mathematical scientists	10	(2)	(1)
Chemists	30	.02	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	490	.37	0.77
Engineers	2,710	2.02	(1)
Chemical	20	.01	(1)
Civil	30	.02	(1)
Electrical/electronic	570	.43	.26
Computer	40	.03	5.84
Industrial	730	.55	.05
Mechanical	850	.65	.21
Metallurgists/metallurgical	40	.03	(1)
Safety	40	.03	(1)
Sales	40	.03	(1)
Other, n.e.c	350	.26	(1)
Technicians	1,680	1.24	(1)
Computer programmer	260	.19	.37
Drafter	440	.33	.35
Electrical/electronic technicians	330	.25	.42
Mechanical engineering technician	290	.22	(1)
Industrial engineering technicians	110	.08	(1)
Civil engineering technician	10	(2)	(1)
All other engineering technicians	210	.16	(1)
Chemical technicians	20	.01	(1)
Petroleum technicians	10	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Electric lighting and wiring equipment (SIC 3640)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	11,250	5.56	(1)
Scientists	740	.36	(1)
Computer analysts	540	.27	4.71
All other computer scientists	30	.01	(1)
Operations and systems researchers and analysts	40	.02	7.81
Mathematical scientists	20	.01	(1)
Chemists	70	.03	4.93
All other physical scientists	40	.02	(1)
Managers of scientific and technical personnel	1,350	.67	3.87
Engineers	5,410	2.68	(1)
Chemical	90	.04	4.74
Civil	10	(2)	(1)
Electrical/electronic	1,440	.72	4.63
Computer	130	.06	12.80
Industrial	1,180	.59	3.90
Mechanical	1,430	.71	2.83
Metallurgists/metallurgical	140	.07	3.54
Safety	80	.04	9.83
Sales	550	.27	4.31
Other, n.e.c	360	.18	(1)
Technicians	3,750	1.85	(1)
Computer programmer	450	.22	5.03
Drafter	1,190	.59	4.68
Electrical/electronic technicians	1,060	.53	4.40
Mechanical engineering technician	260	.13	1.38
Tool programmer, numerical controls	60	.03	2.41
Industrial engineering technicians	230	.11	3.35
Civil engineering technician	10	(2)	(1)
All other engineering technicians	430	.21	(1)
Chemical technicians	40	.02	8.29
Petroleum technicians	20	.01	(1)

Househole audio and video equipment (SIC 3650)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	10,190	11.21	(1)
Scientists	330	.35	(1)
Computer analysts	200	.22	1.85
All other computer scientists	10	.01	(1)
Operations and systems researchers and analysts	20	.02	(1)
Mathematical scientists	90	.09	(1)
Chemists	10	.01	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	570	.63	3.20
Engineers	5,660	6.24	(1)
Chemical	(2)	(2)	(1)
Electrical/electronic	1,750	1.94	6.92
Computer	140	.15	23.02
Industrial	440	.48	.81
Mechanical	340	.37	3.26
Safety	20	.02	(1)
Sales	150	.16	5.34
Other, n.e.c	2,820	3.12	(1)
Technicians	3,630	3.99	(1)
Computer programmer	180	.19	2.18
Drafter	570	.63	2.90
Electrical/electronic technicians	1,710	1.89	6.70
Mechanical engineering technician	70	.07	(1)
Tool programmer, numerical controls	20	.02	(1)
Industrial engineering technicians	150	.16	(1)
All other engineering technicians	930	1.03	(1)
Petroleum technicians	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Communications equipment (SIC 3660)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	73,260	26.10	(1)
Scientists	3,010	1.05	(1)
Computer analysts	2,330	.83	0.62
All other computer scientists	200	.07	(1)
Operations and systems researchers and analysts	300	.10	(1)
Chemists	60	.02	13.23
Physicists and astronomers	110	.03	(1)
All other physical scientists	10	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	5,290	1.89	1.70
Engineers	39,300	14.01	(1)
Chemical	120	.04	3.43
Civil	600	.21	.44
Electrical/electronic	22,320	7.98	1.85
Computer	3,980	1.42	2.50
Industrial	3,050	1.09	.84
Mechanical	4,600	1.64	.70
Metallurgists/metallurgical	110	.03	3.55
Safety	160	.05	(1)
Sales	1,060	.37	1.98
Other, n.e.c	3,300	1.18	(1)
Technicians	25,660	9.15	(1)
Computer programmer	3,360	1.20	5.04
Drafter	3,230	1.15	2.49
Electrical/electronic technicians	14,510	5.19	1.11
Mechanical engineering technician	840	.30	1.91
Tool programmer, numerical controls	120	.04	2.74
Industrial engineering technicians	700	.25	.40
Civil engineering technician	150	.05	(1)
All other engineering technicians	2,580	.92	(1)
Chemical technicians	120	.04	(1)
Petroleum technicians	50	.01	(1)

Electronic components and accessories (SIC 3670)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	137,550	21.91	(1)
Scientists	5,950	.92	(1)
Computer analysts	4,040	.64	1.29
All other computer scientists	250	.04	(1)
Operations and systems researchers and analysts	480	.07	(1)
Mathematical scientists	150	.02	11.24
Chemists	700	.11	3.37
All other physical scientists	310	.04	(1)
Life scientists, unspecified	20	(2)	(1)
Managers of scientific and technical personnel	11,420	1.82	4.40
Engineers	66,590	10.63	(1)
Chemical	1,260	.20	1.95
Civil	900	.14	.31
Electrical/electronic	31,220	5.00	1.46
Computer	6,000	.96	10.34
Industrial	5,630	.90	2.56
Mechanical	5,990	.95	3.58
Metallurgists/metallurgical	1,390	.22	1.93
Safety	580	.09	6.56
Sales	4,110	.65	3.12
Other, n.e.c	9,510	1.52	(1)
Technicians	53,590	8.54	(1)
Computer programmer	4,480	.71	1.90
Drafter	5,390	.86	9.07
Electrical/electronic technicians	29,600	4.74	3.30
Mechanical engineering technician	4,810	.77	1.28
Tool programmer, numerical controls	540	.08	19.10
Industrial engineering technicians	2,280	.36	2.59
Civil engineering technician	160	.02	(1)
All other engineering technicians	4,810	.77	(1)
Chemical technicians	1,360	.21	4.86
Petroleum technicians	160	.02	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Misc. electrical equipment and supplies (SIC 3690)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	18,690	10.67	(1)
Scientists	770	.41	(1)
Computer analysts	440	.25	0.28
All other computer scientists	30	.01	(1)
Operations and systems researchers and analysts	60	.03	(1)
Mathematical scientists	50	.02	(1)
Chemists	110	.06	4.07
Physicists and astronomers	40	.02	33.03
All other physical scientists	40	.02	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	1,360	.78	2.59
Engineers	9,990	5.73	(1)
Chemical	280	.16	8.06
Civil	30	.01	15.71
Electrical/electronic	3,830	2.21	4.99
Computer	650	.37	10.33
Industrial	1,230	.71	1.07
Mechanical	1,460	.84	5.21
Metallurgists/metallurgical	80	.04	14.45
Safety	150	.08	(1)
Sales	460	.26	3.91
Other, n.e.c	1,820	1.05	(1)
Technicians	6,570	3.75	(1)
Computer programmer	420	.24	4.20
Drafter	1,150	.66	3.65
Electrical/electronic technicians	2,790	1.61	5.09
Mechanical engineering technician	380	.21	3.89
Tool programmer, numerical controls	20	.01	(1)
Industrial engineering technicians	290	.16	1.62
Civil engineering technician	90	.05	(1)
All other engineering technicians	820	.47	(1)
Chemical technicians	560	.32	.78
Petroleum technicians	50	.02	(1)

Motor vehicles and equipment (SIC 3710)

Scientists, engineers, and technicians	Total	Percent of total industry employ-ment	Relative error
Scientific and technical personnel	70,250	7.84	(1)
Scientists	5,000	.54	(1)
Computer analysts	2,830	.32	5.14
All other computer scientists	240	.02	(1)
Operations and systems researchers and analysts	400	.04	13.39
Statistician	1,480	.16	(1)
All other mathematicians	40	(2)	(1)
Life scientists, unspecified	10	(2)	(1)
Managers of scientific and technical personnel	3,130	.35	4.77
Engineers	39,210	4.39	(1)
Aeronautical	10	(2)	(1)
Chemical	120	.01	7.15
Civil	160	.01	9.00
Electrical/electronic	1,000	.11	9.21
Computer	350	.03	2.93
Industrial	8,130	.92	7.83
Marine	10	(2)	(1)
Mechanical	6,660	.75	3.98
Metallurgists/metallurgical	350	.03	6.43
Safety	440	.04	5.17
Sales	630	.07	6.79
Other, n.e.c	21,350	2.42	(1)
Technicians	22,910	2.56	(1)
Computer programmer	1,540	.17	7.83
Drafter	5,790	.65	3.07
Electrical/electronic technicians	1,010	.11	5.85
Mechanical engineering technician	1,900	.21	12.15
Tool programmer, numerical controls	160	.01	3.42
Industrial engineering technicians	980	.11	14.01
Civil engineering technician	1,100	.12	2.16
All other engineering technicians	10,060	1.14	(1)
Physical and life science technicians, unspec	370	.04	2.23

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Aircraft and parts (SIC 3720)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	172,640	23.94	(1)
Scientists	16,810	2.32	(1)
Computer analysts	12,640	1.76	0.10
All other computer scientists	740	.10	(1)
Operations and systems researchers and analysts	2,430	.33	(1)
Statistician	650	.09	.43
All other mathematicians	350	.04	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	9,300	1.29	.93
Engineers	107,270	14.91	(1)
Aeronautical	37,680	5.24	.13
Chemical	720	.10	3.83
Civil	1,090	.15	.26
Electrical/electronic	13,510	1.88	.40
Computer	2,210	.30	.49
Industrial	14,580	2.03	.41
Mechanical	13,100	1.82	1.29
Metallurgists/metallurgical	2,160	.30	.75
Safety	870	.12	1.72
Sales	1,380	.19	.73
Other, n.e.c	19,970	2.78	(1)
Technicians	39,260	5.42	(1)
Computer programmer	5,730	.79	1.08
Drafter	5,650	.78	1.23
Electrical/electronic technicians	7,870	1.09	1.27
Mechanical engineering technician	3,780	.52	1.30
Tool programmer, numerical controls	1,510	.21	1.72
Industrial engineering technicians	3,200	.44	.18
Civil engineering technician	850	.11	(1)
All other engineering technicians	9,860	1.37	(1)
Physical and life science technicians, unspec	810	.11	.77

Ship and boat building and repair (SIC 3730)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	14,610	7.45	(1)
Scientists	780	.39	(1)
Computer analysts	560	.28	(1)
All other computer scientists	180	.09	(1)
All other mathematicians	40	.02	(1)
Managers of scientific and technical personnel	1,100	.56	0.26
Engineers	7,330	3.75	(1)
Civil	360	.18	(1)
Marine	780	.40	2.42
Metallurgists/metallurgical	40	.02	4.48
Safety	280	.14	2.81
Sales	20	.01	(1)
Other, n.e.c	5,850	3.00	(1)
Technicians	5,400	2.75	(1)
Computer programmer	200	.10	1.67
Drafter	3,460	1.77	1.03
Electrical/electronic technicians	510	.26	.35
Industrial engineering technicians	40	.02	(1)
All other engineering technicians	870	.44	(1)
Physical and life science technicians, unspec	320	.16	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Railroad equipment (SIC 3740)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,270	3.61	(1)
Scientists	90	.25	(1)
Computer analysts	80	.23	(1)
All other computer scientists	(2)	(2)	(1)
All other mathematicians	10	.02	(1)
Managers of scientific and technical personnel	120	.35	(1)
Engineers	570	1.62	(1)
Civil	10	.02	(1)
Electrical/electronic	90	.26	(1)
Computer	10	.02	(1)
Industrial	120	.35	(1)
Mechanical	190	.56	1.39
Metallurgists/metallurgical	10	.02	(1)
Safety	10	.02	(1)
Sales	110	.32	(1)
Other, n.e.c	20	.05	(1)
Technicians	490	1.39	(1)
Computer programmer	50	.14	4.94
Drafter	300	.88	1.88
Electrical/electronic technicians	40	.11	(1)
Mechanical engineering technician	30	.08	(1)
Tool programmer, numerical controls	20	.05	(1)
Industrial engineering technicians	10	.02	(1)
All other engineering technicians	40	.11	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

Motorbicycles, bicycles, and parts (SIC 3750)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	400	3.03	(1)
Scientists	60	.44	(1)
Computer analysts	40	.30	(1)
All other computer scientists	10	.07	(1)
All other mathematicians	10	.07	(1)
Managers of scientific and technical personnel	30	.23	(1)
Engineers	170	1.30	(1)
Industrial	30	.23	(1)
Mechanical	90	.69	1.31
Other, n.e.c	50	.38	(1)
Technicians	140	1.06	(1)
Computer programmer	30	.23	30.67
Drafter	30	.23	14.82
Mechanical engineering technician	40	.30	(1)
Industrial engineering technicians	10	.07	(1)
All other engineering technicians	30	.23	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989--Continued

Guided missiles, space vehicles, and parts (SIC 3760)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	78,700	38.15	(1)
Scientists	5,740	2.75	(1)
Computer analysts	3,980	1.93	0.06
All other computer scientists	40	.01	(1)
Operations and systems researchers and analysts	880	.42	(1)
Statistician	140	.06	(1)
All other mathematicians	590	.28	(1)
Life scientists, unspecified	110	.05	(1)
Managers of scientific and technical personnel	4,490	2.18	.12
Engineers	52,690	25.59	(1)
Aeronautical	11,230	5.46	(1)
Chemical	570	.27	(1)
Civil	560	.27	(1)
Electrical/electronic	10,470	5.09	.02
Computer	1,690	.82	(1)
Industrial	9,920	4.82	.12
Mechanical	5,400	2.62	.25
Metallurgists/metallurgical	790	.38	(1)
Safety	690	.33	(1)
Sales	150	.07	2.17
Other, n.e.c	11,220	5.46	(1)
Technicians	15,780	7.63	(1)
Computer programmer	2,840	1.38	.32
Drafter	1,260	.61	.71
Electrical/electronic technicians	3,960	1.92	.18
Mechanical engineering technician	2,420	1.17	.31
Tool programmer, numerical controls	160	.07	(1)
Industrial engineering technicians	710	.34	(1)
Civil engineering technician	410	.19	(1)
All other engineering technicians	3,320	1.61	(1)
Physical and life science technicians, unspec	700	.34	1.16

Misc. transportation equipment (SIC 3790)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,170	6.35	(1)
Scientists	40	.08	(1)
Computer analysts	40	.08	(1)
All other computer scientists	(2)	(2)	(1)
All other mathematicians	(2)	(2)	(1)
Managers of scientific and technical personnel	220	.44	0.90
Engineers	1,860	3.73	(1)
Chemical	10	.02	(1)
Civil	40	.08	(1)
Industrial	360	.72	.70
Mechanical	440	.88	3.56
Metallurgists/metallergical	50	.10	(1)
Safety	10	.02	8.33
Sales	10	.02	(1)
Other, n.e.c	940	1.89	(1)
Technicians	1,050	2.10	(1)
Computer programmer	40	.08	1.82
Drafter	310	.62	2.00
Electrical/electronic technicians	40	.08	1.82
Mechanical engineering technician	140	.28	2.55
Tool programmer, numerical controls	10	.02	(1)
All other engineering technicians	510	1.02	(1)
Physical and life science technicians, unspec	(2)	(2)	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Search and navigation equipment (SIC 3810)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	123,260	39.62	(1)
Scientists	9,850	3.16	(1)
Computer analysts	7,110	2.29	0.06
All other computer scientists	1,960	.63	(1)
Operations and systems researchers and analysts	330	.10	(1)
Chemists	40	.01	(1)
All other physical scientists	410	.13	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	10,750	3.46	.20
Engineers	64,060	20.62	(1)
Chemical	160	.05	2.76
Electrical/electronic	37,540	12.09	.28
Computer	3,430	1.10	2.25
Industrial	7,980	2.57	.07
Mechanical	5,370	1.73	.59
Sales	480	.15	2.26
Other, n.e.c.	9,100	2.93	(1)
Technicians	38,600	12.38	(1)
Computer programmer	3,000	.96	.23
Drafter	2,940	.94	.86
Electrical/electronic technicians	22,030	7.09	.32
Mechanical engineering technician	2,960	.95	.52
Tool programmer, numerical controls	120	.03	(1)
Industrial engineering technicians	1,310	.42	.70
All other engineering technicians	4,250	1.36	(1)
Chemical technicians	70	.02	(1)
Petroleum technicians	1,920	.61	(1)

Measuring and controlling devices (SIC 3820)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	73,990	21.68	(1)
Scientists	4,120	1.18	(1)
Computer analysts	2,630	.77	1.28
All other computer scientists	180	.05	(1)
Operations and systems researchers and analysts	200	.05	(1)
Chemists	600	.17	5.76
All other physical scientists	220	.06	(1)
Life scientists, unspecified	290	.08	7.30
Managers of scientific and technical personnel	6,080	1.79	2.95
Engineers	37,400	10.98	(1)
Chemical	660	.19	4.97
Electrical/electronic	14,520	4.27	2.36
Computer	6,020	1.77	2.19
Industrial	4,240	1.24	1.29
Mechanical	5,170	1.52	3.76
Sales	2,940	.86	7.47
Other, n.e.c.	3,850	1.13	(1)
Technicians	26,390	7.73	(1)
Computer programmer	2,220	.65	10.78
Drafter	4,560	1.34	4.18
Electrical/electronic technicians	12,780	3.76	3.73
Mechanical engineering technician	2,010	.59	9.60
Tool programmer, numerical controls	190	.05	(1)
Industrial engineering technicians	600	.17	3.09
All other engineering technicians	3,370	.99	(1)
Chemical technicians	460	.13	8.00
Petroleum technicians	200	.05	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Medical instruments and supplies (SIC 3840)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	30,040	12.19	(1)
Scientists	3,590	1.43	(1)
Computer analysts	1,180	.48	1.17
All other computer scientists	160	.06	(1)
Operations and systems researchers and analysts	210	.08	1.32
Chemists	730	.29	6.41
All other physical scientists	70	.02	(1)
Life scientists, unspecified	1,240	.50	2.95
Managers of scientific and technical personnel	2,990	1.22	3.01
Engineers	11,630	4.73	(1)
Chemical	360	.14	1.55
Electrical/electronic	3,200	1.31	4.05
Computer	740	.30	5.37
Industrial	1,820	.74	3.17
Mechanical	3,220	1.31	2.68
Sales	430	.17	2.03
Other, n.e.c.	1,860	.76	(1)
Technicians	11,830	4.81	(1)
Computer programmer	900	.36	2.45
Drafter	1,670	.68	5.76
Electrical/electronic technicians	4,320	1.77	4.89
Mechanical engineering technician	1,130	.46	2.94
Tool programmer, numerical controls	90	.03	4.60
Industrial engineering technicians	710	.29	3.48
All other engineering technicians	1,080	.44	(1)
Chemical technicians	1,130	.46	7.42
Petroleum technicians	800	.32	(1)

Opthalmic goods (SIC 3850)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	1,810	4.50	(1)
Scientists	340	.84	(1)
Computer analysts	180	.45	0.56
All other computer scientists	(2)	(2)	(1)
Chemists	110	.27	(1)
All other physical scientists	20	.05	(1)
Life scientists, unspecified	30	.07	(1)
Managers of scientific and technical personnel	230	.57	.80
Engineers	590	1.47	(1)
Chemical	60	.15	2.90
Electrical/electronic	20	.05	43.86
Computer	20	.05	(1)
Industrial	80	.20	(1)
Mechanical	120	.30	.83
Other, n.e.c.	290	.72	(1)
Technicians	650	1.62	(1)
Computer programmer	100	.25	(1)
Drafter	80	.20	2.64
Electrical/electronic technicians	40	.10	(1)
Mechanical engineering technician	60	.15	(1)
All other engineering technicians	170	.42	(1)
Chemical technicians	120	.30	1.19
Petroleum technicians	80	.20	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1985—Continued

Photographic equipment and supplies (SIC 3860)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	10,660	9.87	(1)
Scientists	1,160	1.07	(1)
All other computer scientists	820	.76	(1)
Chemists	280	.26	1.03
All other physical scientists	60	.05	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	900	.84	5.19
Engineers	4,290	3.98	(1)
Chemical	360	.33	2.28
Electrical/electronic	990	.92	8.87
Computer	420	.39	7.46
Mechanical	700	.65	4.47
Sales	80	.07	14.68
Other, n.e.c	1,740	1.62	(1)
Technicians	4,310	3.98	(1)
Drafter	470	.43	9.97
Electrical/electronic technicians	980	.91	9.73
Mechanical engineering technician	330	.30	8.17
Tool programmer, numerical controls	10	(2)	23.92
All other engineering technicians	1,400	1.30	(1)
Chemical technicians	400	.37	1.95
Petroleum technicians	720	.67	(1)

Watches, clocks, watchcases, and parts (SIC 3870)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	490	4.21	(1)
Scientists	30	.25	(1)
Computer analysts	20	.17	(1)
All other computer scientists	10	.08	(1)
All other physical scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	60	.52	(1)
Engineers	160	1.38	(1)
Electrical/electronic	60	.52	(1)
Industrial	50	.43	(1)
Mechanical	30	.26	(1)
Other, n.e.c	20	.17	(1)
Technicians	240	2.06	(1)
Computer programmer	30	.26	(1)
Drafter	40	.34	(1)
Electrical/electronic technicians	110	.95	(1)
Industrial engineering technicians	30	.26	(1)
All other engineering technicians	20	.17	(1)
Petroleum technicians	10	.08	(1)

Jewelry, silverware, and plated ware (SIC 3910)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	460	0.79	(1)
Scientists	120	.21	(1)
Computer analysts	100	.18	0.83
All other computer scientists	20	.03	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	90	.16	3.50
Engineers	90	.15	(1)
Industrial	40	.07	(1)
Mechanical	40	.07	1.62
Other, n.e.c	10	.01	(1)
Technicians	160	.27	(1)
Computer programmer	110	.20	3.78
Industrial engineering technicians	30	.05	(1)
All other engineering technicians	10	.01	(1)
Physical and life science technicians, unspec	10	.01	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Musical instruments (SIC 3930)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	280	2.11	(1)
Scientists	10	.07	(1)
Computer analysts	10	.07	18.11
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	40	.30	5.28
Engineers	90	.68	(1)
Industrial	40	.30	4.41
Mechanical	20	.15	(1)
Other, n.e.c	30	.23	(1)
Technicians	140	1.06	(1)
Computer programmer	20	.15	(1)
Drafter	60	.46	5.38
Mechanical engineering technician	10	.07	20.38
All other engineering technicians	50	.38	(1)

Toys and sporting goods (SIC 3940)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,030	2.80	(1)
Scientists	330	.30	(1)
Computer analysts	290	.27	1.77
All other computer scientists	40	.03	(1)
Life scientists, unspecified	(2)	(2)	(1)
Managers of scientific and technical personnel	430	.40	1.70
Engineers	1,210	1.13	(1)
Industrial	410	.38	.84
Mechanical	530	.50	1.23
Sales	(2)	(2)	(1)
Other, n.e.c	270	.25	(1)
Technicians	1,060	.97	(1)
Computer programmer	230	.21	3.96
Drafter	350	.33	4.61
Mechanical engineering technician	80	.07	(1)
Industrial engineering technicians	90	.08	3.87
All other engineering technicians	280	.26	(1)
Physical and life science technicians, unspec	30	.02	(1)

Pens, pencils, office and art supplies (SIC 3950)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	770	2.10	(1)
Scientists	90	.24	(1)
Computer analysts	80	.22	4.15
All other computer scientists	10	.02	(1)
Managers of scientific and technical personnel	130	.36	2.80
Engineers	270	.75	(1)
Industrial	80	.22	4.89
Mechanical	150	.42	2.09
Other, n.e.c	40	.11	(1)
Technicians	280	.75	(1)
Computer programmer	60	.16	(1)
Drafter	80	.22	6.53
Mechanical engineering technician	20	.05	(1)
Industrial engineering technicians	20	.05	(1)
All other engineering technicians	70	.19	(1)
Physical and life science technicians, unspec	30	.08	(1)

See explanatory information, if any, and SOURCES at end of table.

Table A-3. Scientists, engineers, and technicians in each manufacturing industry, as a percent of total employment in the industry, and the relative error: 1989—Continued

Costume jewelry and notions (SIC 3960)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	450	1.20	(1)
Scientists	40	.11	(1)
Computer analysts	40	.11	1.62
All other computer scientists	(2)	(2)	(1)
Managers of scientific and technical personnel	90	.25	7.78
Engineers	160	.43	(1)
Industrial	60	.16	(1)
Mechanical	60	.16	3.24
Other, n.e.c	40	.11	(1)
Technicians	160	.41	(1)
Computer programmer	60	.16	7.68
Drafter	20	.05	4.00
Mechanical engineering technician	20	.05	(1)
Industrial engineering technicians	20	.05	8.33
All other engineering technicians	30	.08	(1)
Physical and life science technicians, unspec	10	.02	(1)

Misc. manufactures (SIC 3990)

Scientists, engineers, and technicians	Total	Percent of total industry employment	Relative error
Scientific and technical personnel	3,730	2.53	(1)
Scientists	350	.23	(1)
Computer analysts	220	.15	3.71
All other computer scientists	120	.08	(1)
Life scientists, unspecified	10	(2)	(1)
Managers of scientific and technical personnel	340	.23	2.36
Engineers	1,040	.71	(1)
Industrial	170	.11	3.00
Mechanical	360	.25	4.99
Sales	60	.04	4.34
Other, n.e.c	450	.31	(1)
Technicians	2,000	1.36	(1)
Computer programmer	280	.19	4.82
Drafter	1,170	.81	4.64
Mechanical engineering technician	130	.09	2.94
Industrial engineering technicians	100	.06	4.80
All other engineering technicians	250	.17	(1)
Physical and life science technicians, unspec	70	.04	9.89

(1) Relative error was not computed.

(2) Value is less than .05 or was not computed.

NOTES: Industries are categorized in accordance with the Standard Industrial Classification (SIC) codes.

Because of rounding, components may not add to totals.

N.e.c. = not elsewhere classified

SOURCES: Occupational Employment Statistics survey of the Bureau of Labor Statistics, and National Science Foundation/SRS.

Table A-4. R&D scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by detailed industry of employment: 1989

Numbers of filled jobs in thousands

Detailed industry	Total SET(1) personnel		SET personnel managers		R&D scientists		R&D engineers		R&D Technicians	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total manufacturing	191.1	100.0	20.0	100.0	37.8	100.0	77.7	100.0	55.6	100.0
DURABLE GOODS	118.2	61.8	13.6	68.0	5.6	14.8	66.6	85.7	32.4	58.3
Lumber and wood products	.3	.1	(2)	.2	(2)	.1	.1	.1	.1	.2
Logging	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Sawmills and planing mills	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Millwork, plywood & structural members	.2	.1	(2)	.1	(2)	(2)	.1	.1	.1	.1
Wood containers	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Wood buildings and mobile homes	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1
Misc. wood products	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Furniture and fixtures	.6	.3	.1	.6	(2)	(2)	.2	.2	.3	.5
Household furniture	.1	.1	(2)	.1	(2)	(2)	(2)	(2)	.1	.1
Office furniture	.1	.1	(2)	.2	(2)	(2)	(2)	(2)	(2)	.1
Public building & related furniture	.1	.1	(2)	(2)	(2)	(2)	(2)	(2)	.1	.1
Partitions and fixtures	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1
Misc. furniture and fixtures	.2	.1	(2)	.1	(2)	(2)	.1	.1	(2)	.1
Stone, clay, and glass products	.9	.5	.1	.5	.1	.2	.3	.4	.4	.8
Flat glass	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Glass and glassware, pressed or blown	.1	.1	(2)	(2)	(2)	(2)	(2)	.1	.1	.1
Products of purchased glass	.2	.1	(2)	.1	(2)	.1	(2)	.1	.1	.1
Cement, hydraulic	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Structural clay products	.1	.1	(2)	(2)	(2)	(2)	.1	.1	(2)	.1
Pottery and related products	.2	.1	(2)	.1	(2)	(2)	.1	.1	.1	.2
Concrete, gypsum, and plaster products	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1
Misc. nonmetallic mineral products	.2	.1	(2)	.1	(2)	.1	.1	.1	.1	.2
Primary metals	3.3	1.7	.5	2.4	.3	.9	1.3	1.6	1.2	2.1
Blast furnaces and basic steel products	.8	.4	.3	1.5	(2)	.1	.2	.2	.3	.5
Iron and steel foundries	.2	.1	(2)	.1	(2)	(2)	.1	.2	(2)	.1
Primary nonferrous metals	.1	.1	(2)	(2)	(2)	.1	(2)	(2)	(2)	.1
Secondary nonferrous metals	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Nonferrous rolling and drawing	1.9	1.0	.1	.5	.2	.6	.8	1.1	.8	1.4
Nonferrous foundries (castings)	.1	(2)	(2)	.1	(2)	(2)	(2)	.1	(2)	.1
Misc. primary metal products	0.1	0.1	(2)	(2)	(2)	0.1	(2)	0.1	(2)	0.1
Fabricated metal products	3.6	1.9	0.7	3.4	(2)	.1	1.5	2.0	1.3	2.4
Metal cans and shipping containers	(2)	(2)	(2)	(2)	0.0	(2)	(2)	(2)	(2)	(2)
Cutlery, handtools, and hardware	.3	.2	.1	.3	(2)	(2)	.1	.2	.1	.2
Plumbing and heating, except electric	.3	.1	.1	.3	(2)	(2)	.1	.1	.1	.2
Fabricated structural metal products	.9	.5	.1	.7	(2)	(2)	.3	.4	.5	.8
Screw machine products, bolts, etc.	.3	.1	.1	.3	(2)	(2)	.1	.1	.1	.2
Metal forgings and stampings	.3	.2	(2)	.1	(2)	(2)	.2	.3	.1	.2
Metal services, n.e.c.	.1	(2)	(2)	.1	(2)	(2)	(2)	(2)	(2)	.1
Ordnance and accessories, n.e.c.	.6	.3	.1	.6	(2)	(2)	.4	.5	(2)	.1
Misc. fabricated metal products	.9	.5	.2	.8	(2)	(2)	.4	.5	.3	.6
Machinery, except electrical	26.6	13.9	3.6	18.0	.5	1.3	16.4	21.1	6.1	10.9
Engines and turbines	1.0	.5	.1	.3	(2)	(2)	.5	.7	.4	.7
Farm and garden machinery	.8	.4	.1	.7	(2)	(2)	.4	.6	.2	.4
Construction and related machinery	1.4	.8	.3	1.2	(2)	.1	.8	1.0	.4	.7
Metalworking machinery	1.3	.7	.3	1.4	(2)	(2)	.6	.8	.3	.6
Special industry machinery	2.0	1.1	.4	2.0	(2)	.1	1.0	1.2	.6	1.1
General industrial machinery	2.0	1.1	.3	1.7	(2)	.1	.9	1.2	.7	1.3
Computer and office equipment	15.1	7.9	1.9	9.7	.4	1.1	10.3	13.3	2.5	4.4
Refrigeration and service machinery	.7	.4	.2	.8	(2)	.1	.3	.4	.3	.5
Misc. machinery, n.e.c.	2.1	1.1	(2)	(2)	(2)	(2)	1.4	1.8	.7	1.2
Electrical machinery	23.8	12.5	3.1	15.5	.6	1.6	13.8	17.8	6.3	11.4
Electric distribution equipment	.3	.2	(2)	.2	(2)	(2)	.2	.2	.1	.2
Electrical industrial apparatus	2.9	1.5	.3	1.3	.2	.4	1.5	2.0	.9	1.6
Household appliances	.3	.2	.1	.3	(2)	(2)	.2	.2	.1	.2
Electric lighting and wiring equipment	1.0	.5	.3	1.3	(2)	.1	.4	.5	.3	.6
Household audio and video equipment	.8	.4	.1	.5	(2)	(2)	.4	.5	.2	.4
Communications equipment	7.9	4.1	.9	4.6	.2	.6	4.8	6.2	1.9	3.5
Electronic components and accessories	8.8	4.6	1.1	5.7	.1	.2	5.6	7.2	2.0	3.6
Misc. electrical equipment and supplies	1.7	.9	.3	1.4	.1	.2	.7	.9	.7	1.2
Transportation equipment	33.1	17.3	2.7	13.7	2.0	5.2	19.7	25.3	8.7	15.6
Motor vehicles and equipment	16.1	8.4	0.9	4.4	0.8	2.2	8.5	11.0	5.9	10.6
Aircraft and parts	7.8	4.1	.9	4.6	.4	1.0	5.3	6.8	1.3	2.3
Ship and boat building and repairing	.1	.1	(2)	.2	(2)	(2)	.1	.1	(2)	.1
Railroad equipment	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Motorbicycles, bicycles, and parts	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Guided missiles, space vehicles, parts	8.4	4.4	.9	4.3	.8	2.1	5.6	7.2	1.1	2.1
Misc. transportation equipment	.5	.2	(2)	.1	(2)	(2)	.2	.2	.3	.5
Instruments	25.0	13.1	2.5	12.7	2.0	5.2	12.9	16.7	7.6	13.6
Search and Navigation equipment	9.1	4.8	.7	3.7	.6	1.7	5.9	7.6	1.8	3.3
Measuring and controlling devices	8.5	4.4	1.0	5.2	.4	1.2	4.5	5.8	2.5	4.6
Medical instruments and supplies	5.8	3.0	.7	3.4	.8	2.0	2.3	3.0	2.1	3.7
Opthalmic goods	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1
Photographic equipment and supplies	1.4	.8	(2)	.2	.1	.3	.2	.3	1.1	1.9
Watches, clocks, watchcases, and parts	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. manufacturing	1.0	.5	.2	.9	(2)	(2)	.4	.5	.4	.8
Jewelry, silverware, and plated ware	(2)	(2)	(2)	.1	(2)	(2)	(2)	(2)	(2)	(2)
Musical instruments	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Toys and sporting goods	.5	.2	.1	.5	(2)	(2)	.1	.2	.2	.4
Pens, pencils, office & art supplies	(2)	(2)	(2)	.1	(2)	(2)	(2)	(2)	(2)	(2)
Costume jewelry and notions	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. manufactures	.4	.2	(2)	.2	(2)	(2)	.2	.3	.2	.4

See explanatory information, if any, and SOURCES at end of table.

Table A-4. R&D scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by detailed industry of employment: 1989--Continued

Numbers of filled jobs in thousands

Detailed industry	Total SET(1) personnel		SET personnel managers		R&D scientists		R&D engineers		R&D Technicians	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
NONDURABLE GOODS	72.9	38.2	6.4	31.9	32.2	85.2	11.1	14.3	23.2	41.7
Food and kindred products	4.0	2.1	.6	2.9	1.5	3.9	.3	.4	1.7	3.0
Meat products	.3	.2	.1	.4	(2)	.1	(2)	(2)	.2	.3
Dairy products	.2	.1	(2)	.2	(2)	.1	(2)	(2)	.1	.1
Preserved fruits and vegetables	.8	.4	.1	.5	.4	1.0	(2)	.1	.3	.5
Grain mill products	.3	.2	.1	.3	.1	.2	(2)	(2)	.1	.2
Bakery products	.9	.4	.1	.4	.4	1.0	(2)	.1	.4	.6
Sugar and confectionery products	.4	.2	(2)	.2	.1	.4	(2)	(2)	.2	.4
Fats and oils	.1	.1	(2)	(2)	.1	.2	(2)	(2)	.1	.1
Beverages	.4	.2	(2)	.1	.1	.4	(2)	(2)	.2	.3
Misc. food and kindred products	0.7	0.4	0.1	0.6	0.2	0.5	0.1	0.2	0.2	0.4
Tobacco products	.5	.3	(2)	(2)	.3	.8	.1	.1	.2	.3
Cigarettes	.5	.3	(2)	(2)	.3	.8	.1	.1	.2	.3
Chewing and smoking tobacco	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Tobacco stemming and redrying	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Textile mill products	.6	.4	.1	.6	.2	.4	.1	.2	.4	.7
Broadwoven fabric mills, cotton	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Broadwoven fabric mills, manmade	.1	(2)	(2)	.1	(2)	.1	(2)	(2)	(2)	.1
Broadwoven fabric mills, wool	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Narrow fabric mills	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Knitting mills	.1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	.1
Textile finishing, except wool	(2)	(2)	(2)	(2)	(2)	.1	(2)	(2)	(2)	(2)
Carpets and rugs	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Yarn and thread mills	.1	(2)	(2)	(2)	(2)	.1	(2)	(2)	(2)	.1
Misc. textile goods	.4	.2	.1	.3	.1	.2	(2)	.1	.2	.4
Apparel and other finished products made from fabrics and similar materials	.3	.2	.1	.3	(2)	(2)	.1	.1	.1	.3
Men's and boys' suits and coats	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Men's and boys' furnishings	.1	.1	(2)	(2)	(2)	(2)	.1	.1	.1	.1
Women's and misses' outerwear	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Women's and children's undergarments	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hats, caps, and millinery	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Girls' and children's outerwear	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. apparel and accessories	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. fabricated textile products	.1	.1	.1	.3	(2)	(2)	(2)	(2)	.1	.1
Paper and allied products	2.1	1.1	.1	.3	.7	2.0	.7	.9	.6	1.1
Pulp mills	.1	.1	(2)	(2)	.1	.2	(2)	(2)	.1	.1
Paper mills	.7	.4	.1	.3	.2	.5	.1	.2	.3	.5
Paperboard mills	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Paperboard containers and boxes	.1	.1	(2)	(2)	(2)	.1	(2)	.1	(2)	.1
Misc. converted paper products	1.2	.6	(2)	(2)	.4	1.2	.5	.7	.2	.4
Printing, publishing, and allied industries	0.4	0.2	0.1	0.5	0.1	0.4	(2)	0.1	0.1	0.2
Newspapers	.1	(2)	(2)	.1	(2)	(2)	(2)	(2)	(2)	(2)
Periodicals	.1	(2)	(2)	.1	(2)	.1	0.0	(2)	(2)	(2)
Books	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Misc. publishing	.1	.1	(2)	.1	(2)	.1	(2)	(2)	(2)	.1
Commercial printing	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Manifold business forms	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Greeting cards	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Blankbooks and bookbinding	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Printing trade services	.1	(2)	(2)	.1	(2)	.1	(2)	(2)	(2)	.1
Chemicals and allied products	56.5	29.5	4.7	23.5	27.8	73.5	7.0	9.0	16.9	30.4
Industrial inorganic chemicals	4.5	2.4	.4	2.2	1.7	4.5	1.2	1.6	1.2	2.1
Plastics materials and synthetics	6.0	3.1	.7	3.4	1.3	3.3	1.8	2.3	2.3	4.1
Drugs	20.1	10.5	1.8	8.8	13.4	35.6	.7	.9	4.2	7.6
Soaps, cleaners, and toilet goods	4.8	2.5	.6	2.9	2.5	6.6	.5	.6	1.2	2.2
Paints and allied products	3.2	1.7	.1	.7	1.6	4.2	.3	.4	1.2	2.2
Industrial organic chemicals	13.6	7.1	.7	3.4	5.0	13.3	2.1	2.7	5.7	10.2
Agricultural chemicals	.7	.4	(2)	(2)	.5	1.4	(2)	.1	.2	.3
Misc. chemical products	3.5	1.8	.4	1.9	1.8	4.7	.4	.5	.9	1.7
Petroleum refining and related products	4.8	2.5	.2	.9	1.2	3.2	1.4	1.8	2.0	3.7
Petroleum refining	4.5	2.4	.1	.7	1.1	2.8	1.4	1.8	1.9	3.5
Asphalt paving and roofing materials	.1	(2)	(2)	(2)	(2)	.1	(2)	(2)	(2)	(2)
Misc. petroleum and coal products	.2	.1	(2)	.2	.1	.3	(2)	(2)	.1	.1
Rubber and miscellaneous plastics products	3.3	1.7	.5	2.6	.4	1.0	1.2	1.6	1.2	2.1
Tires and inner tubes	.3	.2	.0	.0	(2)	.1	.1	.2	.1	.2
Rubber and plastics footwear	(2)	(2)	.0	.0	(2)	(2)	(2)	(2)	.0	.0
Hose & belting & gaskets & packing	.3	.2	.1	.4	(2)	.1	.1	.1	.1	.2
Fabricated rubber products, n.e.c.	.6	.3	.1	.4	.1	.2	.2	.3	.2	.3
Misc. plastic products, n.e.c.	2.1	1.1	.3	1.7	.2	.6	.8	1.0	.7	1.3
Leather and leather products	.1	(2)	(2)	.1	(2)	.1	(2)	(2)	(2)	(2)
Leather tanning and finishing	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Footwear cut stock	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Footwear, except rubber	(2)	(2)	(2)	(2)	(2)	.1	(2)	(2)	(2)	(2)
Luggage	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Handbags and personal leather goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leather goods, n.e.c.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

(1) Scientific, engineering, and technical
(2) No amount available or value less than .05 for levels and .005 for percents
NOTES: Because of rounding, components may not add to totals.
N.e.c. = Not elsewhere classified
SOURCES: Occupational Employment Statistics Survey of the Bureau of Labor Statistics, and the National Science Foundation, SRS.

Table A-5. R&D scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1989

Numbers of filled jobs in thousands

Broad industry group of employment	Total SET personnel	SET managers	Scientists				
			Total	Physical	Mathe- matical	Life	Computer analyst
Total manufacturing......	191.1	20.0	37.9	21.3	0.6	11.5	4.4
DURABLE GOODS...........	118.2	13.6	5.6	1.3	.4	.7	3.2
Lumber and wood products..............	.3	(3)	(3)	-	-	(3)	-
Furniture and fixtures	.6	.1	(3)	-	-	-	(3)
Stone, clay, and glass products..............	.9	.1	.1	.1	-	-	-
Primary metals.........	3.3	.5	.3	.3	-	-	(3)
Fabricated metal products..............	3.6	.7	(3)	-	-	(3)	(3)
Machinery, except electrical............	26.6	3.6	.5	-	(3)	(3)	.5
Electrical machinery..	23.8	3.1	.6	.3	(3)	-	.3
Transportation equipment.............	33.1	2.7	2.0	-	.3	-	1.7
Instruments............	25.0	2.5	2.0	.6	-	.6	.7
Miscellaneous manufacturing..........	1.0	.2	(3)	-	-	-	(3)
NONDURABLE GOODS.........	72.9	6.4	32.2	19.9	.2	10.9	1.2
Food and food products	4.0	.6	1.5	1.2	-	.3	-
Tobacco products.......	.5	-	.3	.3	-	(3)	(3)
Textiles...............	.8	.1	.2	.2	-	-	(3)
Apparel................	.3	.1	(3)	-	-	-	(3)
Paper and allied products..............	2.1	.1	.7	.7	.0	(3)	(3)
Printing and publishing.............	.4	.1	.1	-	-	-	.1
Chemicals..............	56.5	4.7	27.8	16.2	.2	10.5	.3
Refined petroleum products..............	4.8	.2	1.2	1.1	-	-	.1
Rubber and plastic products..............	3.3	.5	.4	.3	-	-	(3)
Leather products.......	.1	(3)	(3)	-	-	-	(3)

See explanatory information, if any, and SOURCES at end of table.

Table A-5. R&D scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1989--Continued

Numbers of filled jobs in thousands

Broad industry group of employment	Engineers								
	Total	Aero-nau-tical	Chem-ical	Civil	Elec-trical/elec-tronics	Mechan-ical	Indus-trial	Sales	Other
Total manufacturing.....	77.7	5.6	6.5	0.1	24.4	9.4	1.7	0.0	30.1
DURABLE GOODS............	66.6	5.6	.8	(3)	24.2	8.1	1.4	-	26.4
Lumber and wood products...............	.1	-	-	-	-	(3)	(3)	-	(3)
Furniture and fixtures	.2	-	-	-	-	(3)	-	-	.1
Stone, clay, and glass products...............	.3	-	(3)	-	(3)	(3)	-	-	.3
Primary metals.........	1.3	-	-	-	.1	.1	(3)	-	1.0
Fabricated metal products...............	1.5	-	-	(3)	.1	.8	.2	-	.5
Machinery, except electrical.............	16.4	-	(3)	-	6.1	2.7	.3	-	7.3
Electrical machinery..	13.8	-	.2	-	9.3	1.1	.1	-	2.9
Transportation equipment..............	19.7	5.6	.2	-	.3	1.3	.5	-	11.8
Instruments............	12.9	-	.3	-	8.3	1.8	.3	-	2.2
Miscellaneous manufacturing..........	.4	-	-	-	-	.2	(3)	-	.2
NONDURABLE GOODS.........	11.1	-	5.6	(3)	.2	1.3	.3	-	3.7
Food and food products	.3	-	-	-	-	(3)	(3)	-	.3
Tobacco products.......	.1	-	-	-	-	-	-	-	.1
Textiles................	.1	-	-	-	-	(3)	(3)	-	.1
Apparel.................	.1	-	-	-	-	(3)	-	-	.1
Paper and allied products...............	.7	.0	.2	.0	.0	.0	.0	.0	.5
Printing and publishing..............	(3)	-	-	-	-	(3)	-	-	(3)
Chemicals..............	7.0	-	4.1	(3)	.1	.6	.2	-	2.0
Refined petroleum products...............	1.4	-	.9	-	-	-	-	-	.4
Rubber and plastic products...............	1.2	-	.3	-	.1	.6	(3)	-	.2
Leather products.......	(3)	-	-	-	-	-	-	-	(3)

See explanatory information, if any, and SOURCES at end of table.

Table A-5. R&D scientific, engineering, and technical (SET) personnel and SET managers in manufacturing industries, by broad industry group of employment and detailed occupation: 1983--Continued

Numbers of filled jobs in thousands

Broad industry group of employment	Technicians								
					Engineering				
	Total	Computer programmer	Drafter	Science	Total	Electrical/ electronics	Mechanical	Civil	Other
Total manufacturing	55.6	2.3	5.5	23.6	24.2	9.1	3.8	0.0	11.3
DURABLE GOODS	32.4	2.0	5.2	3.6	21.6	8.9	3.5	-	9.1
Lumber and wood products	.1	-	(3)	-	.1	-	-	-	.1
Furniture and fixtures	.3	-	.2	-	.1	-	-	-	.1
Stone, clay, and glass products	.4	-	(3)	.1	.3	(3)	-	-	.3
Primary metals	1.2	-	(3)	.5	.7	(3)	-	-	.6
Fabricated metal products	1.3	(3)	.5	.1	.7	.1	.3	-	.3
Machinery, except electrical	6.1	1.1	1.3	.3	3.4	1.6	.9	-	.9
Electrical machinery	6.3	.4	1.5	.2	4.2	3.3	.3	-	.7
Transportation equipment	8.7	-	.2	.3	8.2	1.0	1.6	-	5.5
Instruments	7.6	.5	1.2	2.1	3.8	2.7	.4	-	.6
Miscellaneous manufacturing	.4	(3)	.2	(3)	.2	-	(3)	-	.1
NONDURABLE GOODS	23.2	.3	.3	20.0	2.6	.2	.3	-	2.1
Food and food products	1.7	-	-	1.4	.3	-	-	-	.3
Tobacco products	.2	-	-	.2	(3)	-	-	-	(3)
Textiles	.4	-	-	.2	.1	-	(3)	-	.1
Apparel	.1	-	-	(3)	.1	-	-	-	.1
Paper and allied products	.6	.0	(3)	.4	.2	(3)	.0	.0	.1
Printing and publishing	.1	.1	-	-	(3)	-	-	-	(3)
Chemicals	16.9	.2	.1	15.5	1.1	.1	.1	-	.9
Refined petroleum products	2.0	-	-	1.6	.4	(3)	-	-	.4
Rubber and plastic products	1.2	-	.2	.6	.4	(3)	.2	-	.2
Leather products	(3)	-	-	(3)	-	-	-	-	-

(1) Scientific, engineering, and technical personnel
(2) Scientific and engineering
(3) Value is less than .05
NOTES: Because of rounding, components may not add to totals.
"-" = No amount available.
SOURCES: Bureau of Labor Statistics and the National Science Foundation, SRS.

APPENDIX. TECHNICAL NOTES

Scope of the Survey

The Occupational Employment Statistics (OES) Survey[1] is the source of extensive and detailed data on employed scientists, engineers, and technicians (SETs) in U.S. industry. It is conducted in 3-year cycles: Manufacturing industries are surveyed in the first year; mining, construction, and financial and other service industries in the nonmanufacturing sector are surveyed in the second; and trade, communications, transportation, and public utilities are surveyed in the third year. Data in this report are from the 1989 Manufacturing Industries Survey, covering Standard Industrial Classification (SIC) codes 20-39. The reference dates of the survey were the weeks that included April 12, May 12, or June 12, 1989, depending on the SIC code of the sampled unit. The survey covered all 50 States and the District of Columbia.

Method of Collection

Survey forms for the OES Survey are mailed to personnel offices of most sample establishments. In a few cases forms are mailed to the company headquarters. The responses supplied by the companies are then separated according to establishment by the Regional Office in which the company headquarters is located. The Regional Office then forwards the data to the state in which the respective establishments are located. Nonrespondents receive two additional mailings at 6-week intervals with telephone followups. Responses from the larger companies are critical to the survey. When they do not respond to the mailed questionnaire, but will provide the data in person, survey field personnel arrange a meeting for this purpose.

Survey questionnaires are tailored for specific industries at the 2-digit SIC level so that data can be aggregated at that level. The survey is conducted at the more detailed 3-digit SIC level. Each industry surveyed receives a separate questionnaire in which the job categories reflect the jobs of all or almost all employees in that industry. On the questionnaires, specific jobs are grouped under broad headings, each with a residual category for jobs not explicitly listed on the survey form. Abbreviated survey forms that combine kindred jobs are sent to small establishments to diminish the reporting burden and to encourage participation.

Impacts of Data Collection Methodology on Survey Estimates

The data collection methodology used in the OES Survey is such that several problems must be taken into account when using the data. First, the OES survey may sometimes understate employment in specific fields. If an occupation is very small in an industry, it will not be explicitly listed on that industry's questionnaire. For example, there are few biologists in the Communications industry, and thus the occupational category "biologist" is not on the survey questionnaire; rather, the more aggregated category of "life scientist" is used. Further, if past surveys had found few "life scientists" in an industry, the "life scientists" would be put in the even more aggregated category of "all other professionals," for which data would not be included in this report. This survey characteristic can be expected to overstate cross-industry differences in staffing patterns. Finally, BLS in 1988 increased the number of industries in which S&E managers were separately identified (see "Reconciliation with 1986 OES Data").

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[1] A description of the OES Survey can be found in the Department of Commerce, ***The National OES-Based Industry-Occupational Matrix, 1982 and 1995*** (Springfield, VA.: National Technical Information Service).

Data in this publication on R&D scientists, engineers, and technicians (R&DSETs) are the first such estimates published, and refer to those who spend the "greatest proportion of time... on R&D." Scientists, engineers, and technicians who spend less time on R&D are excluded from this R&DSET subset, but are included in the overall SET estimates. Thus, the R&DSET numbers herein are not intended as full-count estimates.

Job and Industry Classification

Data collected in the OES Survey are for approximately 60 SET jobs, and are classified according to the ***Dictionary of Occupational Titles*** (DOT) and the ***Standard Occupational Classification System*** (SOC). The DOT system is used to develop single job categories and definitions because its classification scheme is detailed; the broad job categories used in this report are SOC categories. These two classification systems combined form the job classification system used in this report, as well as for all OES estimates.

Surveyed industries are classified according to the SIC coding System, revised in 1987. Reporting establishments are categorized on the basis of their major product or activity during the previous calendar year.

Reconciliation with 1986 OES Data

The OES Survey depicts the structure of total employment by industry, including SET personnel. The 1987 revisions to the SIC coding system were used in the 1989 OES Survey, so that only all-industry SET estimates in this report are fully comparable with those of the 1986 report. The numbers of SET personnel in most 2-digit level industries are largely or fully comparable for 1989 and 1986, except for electrical machinery (SIC 36) and instruments (SIC 38). At the 3-digit SIC level, relatively fewer industries have comparable data for 1989 and 1986. The titles of some industries changed, but such industries neither gained from nor lost SETs to other industries.

Data for all SET personnel are given in table A-1 by 2- and 3-digit levels of industry, in table A-2 by 2-digit level of industry, and in table A-3 by 3-digit level of industry. Tables A-4 and A-5 concern only R&D personnel and otherwise correspond to tables A-1 and A-2.

The numbers of SET managers in this report should not be compared with those published in ***Scientists, Engineers, and Technicians in Manufacturing Industries: 1986*** (NSF 88-337). The 1989 OES Survey found 144,400 SET managers, versus 124,500 in 1986. A small part of this increase may reflect enhanced reporting of scientific and technical managers in 1989 when some small industries began reporting SET managers as a separate survey item.

Several computer-related occupations also are not fully comparable for 1986 and 1989. Some personnel in electrical and electronics engineering in 1986 will now be found in the new category of computer engineer or in the computer analyst category. Computer engineers are now a subset of "other" engineers.

Reconciliation with Other SRS Data Series

NSF supports three surveys covering scientists and engineers in industry: The OES Survey, the Survey of Research and Development in Industry (RDI), and the Scientific and Technical Personnel Data System (STPDS). These surveys cover different aspects of science and engineering (S&E) employment and characteristics. Because the survey definitions, concepts, coverage, and methods of collection vary widely, the resulting estimates differ. Two of the survey questionnaires are completed by employers. One, the OES Survey, occurs at the establishment (workplace) level. The other, the RDI Survey, occurs at the company headquarters level. The STPDS questionnaires are population-based, i.e., they are completed by the scientists and engineers themselves.

The data from the 1989 OES Survey herein cover total SETs and the R&DSET subset. The OES Survey, conducted by the Bureau of Labor Statistics (BLS), is an establishment-based survey of nonfarm employers who report the employment of their wage and salary workers by job type. NSF supports this survey to obtain estimates of the numbers in SET jobs. Published data provide job and industry detail.

The RDI is a company-based survey of R&D-performing firms conducted by the Census Bureau. Its primary objective is to provide statistics on R&D expenditures in U.S. industry. It also collects data on the overall full-time-equivalent (FTE) number of scientists and engineers who perform R&D in these firms. Unlike the OES and the STPDS Surveys, the RDI Survey excludes social scientists. The data provided cover only total numbers of R&D personnel. Further details are in the report titled ***Research and Development in Industry: 1989*** (NSF 92-307).

The STPDS comprises a series of surveys that provides data on employment and other characteristics of personnel who self-classify as scientists (including social and behavioral scientists) and engineers. The STPDS estimates include some personnel employed in non-S&E jobs. They are categorized by work and degree field, S&E field, sector of employment (business, government, academia, etc.), and primary work activity (R&D, teaching, etc). Unlike the OES and RDI estimates, the STPDS estimates do not provide industry detail. For further information see the report, ***U.S. Scientists and Engineers: 1988*** (NSF 90-314).

Concepts

An establishment, such as a factory, is the primary sampling unit in the survey. In general, it represents a single physical location and engages in one type of economic activity.

This report covers several types of personnel: Full-time and part-time workers; workers on paid vacation or on other types of leave; workers on unpaid short-term absence; salaried officers, executives, and staff of firms; employees temporarily assigned to other units; and employees for whom the unit is a permanent duty station. Excluded from coverage are proprietors (owners and partners of unincorporated firms), unpaid family workers, and workers on extended leave.

The data on scientists and engineers in this report relate to their employment in S&E jobs, rather than to their education or training. Employees are categorized as scientists or engineers if they work at a level of knowledge equivalent to that acquired by completion of a 4-year college course with a science or engineering major, even if a college degree was not obtained. Employees who perform multiple functions are reported in the job requiring the highest level of such knowledge. Supervisors who spend at least 20 percent of their time doing work similar to that of individuals under their supervision are classified in the job category most closely related to their work duties.

Sampling Procedures

The OES Survey is a probability sample with a sampling frame based on lists of establishments covered by State Unemployment Insurance (U.I.) systems. Because each cooperating State selects its own sample, the reference date of the sampling frame varies according to when the last sample frame was updated and the survey was conducted. The reference date for sampling in the States BLS surveyed was the second quarter of 1989.

The survey universe is stratified by industry and size of establishment unit because these characteristics are believed to be primary determinants of job staffing patterns. Nine size-classes are represented, based on numbers of people employed: 1 to 5, 5 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 249, 250 to 499, 500 to 999, and 1,000 and over. Because U.I. reporting units with one to three employees are not sampled in every State, units with four to nine employees receive larger weights to represent employment in the smaller size-classes. Reporting units with 250 or more employees are included in the sample with certainty. Samples for noncertainty size-classes are developed to produce State estimates with target relative errors of 10 percent, 15 percent, or 20 percent at one standard deviation. This is done for SIC groups based on averages of occupational rates and coefficients of variation (CVs) from the previous survey of those groups for a set of typical occupations. This SIC sample-size is allocated to the classes in proportion to their employment. The sample is selected systematically with equal probability within each State/SIC/area/ size-class cell. States have the option of targeting relative errors of 10 percent, 15 percent, or 20 percent for noncertainty size-classes. Some States vary the target relative error by SIC to decrease the cost by reducing the sample size.

Response

Of the reporting units selected, 127,801 were eligible, i.e., those out of business and out of scope were excluded. Usable responses were obtained from 101,734 units. The response rates were 79.6 percent based on units and 75.5 percent based on weighted employment. Response rates in most States were much higher than the response rate used to develop national estimates.

Estimation

Weights for the sample units for which usable responses are received reflect two factors. Each weight is based on (1) the reciprocal of the probability of selection and (2) the nonresponse adjustment factor. For questionnaires that were not returned or were otherwise unusable, a nonresponse adjustment factor was calculated to impute for the missing data. For each of the 3-digit SIC/State/size-class sampling cells, the nonresponse factor is calculated as follows:

$$\frac{\text{Weighted employment of all eligible units in sample}}{\text{Weighted employment of all responding eligible units}}$$

Sample employment is taken from the sampling frame. If the nonresponse factor in a cell exceeds a predetermined maximum factor, which increases with the number of respondents in the cell, the cell is collapsed with other homogeneous cells within an SIC until the nonresponse factor for the combined cell is not greater than the appropriate maximum factor. If the collapsing procedure terminates (i.e., no more cells are available for collapse) before satisfying the constraint, then the appropriate maximum factor is used. For size-classes 1 through 6, homogeneous cells are determined to be other size cells within the SIC and State. For size-classes 7 through 9, homogeneous cells are determined to be other State cells within the SIC and size-class. The weight for each unit is the product of the nonresponse adjustment factor and the reciprocal of the probability of selection.

A separate ratio estimate of occupational employment is used to develop national estimates. The auxiliary variable used is total employment. The estimated employment for an occupation at the 3-digit industry i/size-class j level is

$$\hat{P}_{ij}=\left(\sum_{k} W_{ijk}P_{ijk}\right)\left(\sum_{k} \frac{M_{ij}}{W_{ijk}E_{ijk}}\right)$$

where i = a 3-digit industry

j = size-class

k = establishment

$\hat{P}_{ij}$ = estimated employment for occupation P in industry i and size-class j

W_{ijk} = weight for establishment k in industry i and size-class j after adjusting for nonresponse

p_{ijk} = reported employment for occupation P in establishment k within industry i and size-class j

E_{ijk} = reported total employment for establishment k in industry i and size-class j

M_{ij} = population value of total employment for industry i and size-class j.

The population value of total employment (M_{ij}) was obtained from the BLS Universe Data Base files.

The estimated employment for an occupation at the 3-digit industry i level is obtained by summing the occupational employment estimates $\hat{P}_{ij}$ across all 3-digit industries j within industry i.

$$\hat{P}_i = \sum_j \hat{P}_{ij}$$

Similarly, the estimated employment for an occupation at the 2-digit industry g level is obtained by summing the occupational employment estimates $\hat{P}_i$ across all 3-digit industries i within industry g.

$$\hat{P}_g = \sum_i \hat{P}_i$$

Estimates of sampling error are calculated on survey estimates to allow users to determine whether or not the occupational estimates are reliable enough for their needs. Only a probability sample can be used to estimate sampling error from the sample itself.

The formulas used to estimate variance, a common measure of sampling error, are based on both the sample design and the method of estimation. In the OES Survey, the formula used to estimate the variance of occupational employment is a subsample replication technique called the jackknife random group. The jackknife derives estimates of occupational employment from each of several subsamples, and then estimates the variance of the occupational employment figure from the variability between the subsample occupational employment estimates.

The variance for an occupational employment estimate at the 3-digit industry i for size-class j level is

$$S^2(\hat{P}_{ij}) = \frac{1}{(R)(R-1)} \sum_{r=1}^{R} (\hat{P}_{ijr} - \bar{P}_{ij})^2$$

Where

R = number of random groups

$\hat{P}_{ij}$ = estimated employment for occupation P in industry i and size-class j

$\hat{S}^2(P_{ij})$ = estimated variance of $\hat{P}_{ij}$

$\hat{P}_{ijr}$ = estimated pseudo employment for occupation P in industry i, size-class j, and subsample r

$\bar{P}_{ij}$ = estimated mean pseudo employment for occupation P in industry i and size-class j

The variance for an occupational employment estimate at the 3-digit industry i level is obtained by summing the variances $S^2(\hat{P}_{ij})$ across all size-levels j within industry i.

$$S^2(\hat{P}_i) = \sum_{j=1}^{L_i} S^2(\hat{P}_{ij})$$

Where L_i is the number of size levels j in industry i.

Similarly, the variance for an occupational employment estimate at the 2-digit industry g level is obtained by summing the variances $S^2(P_i)$ across all 3-digit industries within industry g.

$$S^2(\hat{P}_g) = \sum_{i=1}^{L_g} S^2(\hat{P}_i)$$

Where L_g is the number of 3-digit industries i in industry g.

Reliability of Estimates

Estimates developed from a sample may differ from the results of a complete census of all the establishments in the sampling frame. Two types of error, sampling and nonsampling, are possible in an estimate based on a sample survey. Sampling error occurs because observations are made only on a sample, not on the entire population. Nonsampling error can be attributed to any of many sources: an inability to obtain information about all cases in the sample; differences in the respondents' interpretation of questions; inability or unwillingness of respondents to provide correct information; errors made in recording, coding, or processing the data; errors made in estimating values for missing data; and failure to represent all units in the population.

The particular sample used in this survey is one of a large number of possible samples of the same size that could have been selected using the same sample design. Estimates derived from the different samples would differ from each other. The deviation of a sample estimate from the average of all possible samples is called the sample error. The standard error of a survey estimate is a measure of the variation among the estimates from all possible samples. Thus, it is a measure of the precision with which an estimate from a particular sample approximates the average results of all possible samples. The relative standard error is defined as the standard error of the estimate divided by the value being estimated. The variance is the standard error squared. In this report, the term "relative error" is synonymous with the term "relative standard error."

The sample estimate and an estimate of its standard error allow construction of interval estimates with prescribed confidence that the interval includes the average result of all possible samples obtainable from the sample design for this survey.

To illustrate, if all possible samples were selected, and each of these was surveyed under essentially the same conditions as the others, and an estimate and its estimated standard error were calculated for each sample, then;

(1) Approximately 68 percent of the intervals from one standard error below to one standard error above the derived estimate would include the average value of all possible samples.

(2) Approximately 90 percent of the intervals from 1.6 standard errors below to 1.6 standard errors above the derived estimate would include the average of all possible samples.

(3) Approximately 95 percent of the intervals from two standard errors below to two standard errors above the derived estimate would include the average of all possible samples.

(4) Almost all intervals from three standard errors below to three standard errors above the derived estimate would include the average of all possible samples.

An inference that the value based on the whole population would be within the indicated ranges would be correct in approximately the foregoing frequencies. For example, suppose an estimated employment total is 5,000 with an associated relative error of 2 percent. Based on these data, the standard error is 100 (= 5,000 X 0.02) and the 68 percent confidence interval is from 4,900 to 5,100 (5,000 + or - 100). A conclusion that the actual total employment lies within a range computed in this manner would be correct for roughly 68 percent of all possible samples.

Relative errors indicate the potential magnitude of the sampling error but do not measure biases in the data resulting from nonsampling error. Many edit and quality control procedures are used to reduce the biases arising from errors in recording, coding, and processing the data. The adjustments made for nonrespondents assume that their characteristics are the same as those of the respondents in a given 3-digit SIC/State/size-class sampling cell. To the extent that this is not true, bias is introduced into the data. The magnitude of these biases is unknown.

Particular care should be exercised when interpreting estimates based on a small number of cases, or on small differences between estimates, because of relatively large sampling errors and the unknown magnitude of the nonsampling biases.

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